An investigation of the female genitalia as taxonomic characters in the Miridae (Hemiptera)

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AN INVESTIGATION OF THE FEMALE GENITALIA AS TAXONOMIC CHARACTERS IN THE MIRIDAE (HEMIPTERA)

by

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A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of The Requirements for the Degree of DOCTOR OF PHILOSOPHY

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INTRODUCTION

This investigation originated as an attempt to discover structures in the genitalia of female Miridae that might be used for taxonomic purposes. The great family Miridae includes a large number of very important economic forms, and the complexity and size of the family makes it imperative that definitive characters be found to properly differentiate the species. The works of Reuter, Van Duzee, and particularly Knight have established differentiating characters in the claspers, or harpagones of the males. However, no parallel studies of the females have been made, with the result that determinations of species in some of the larger genera, which contain many closely related species, such as Lygus, Neolygus, Lopidea and Orthotylus, often have been tentative and sometimes impossible. This paper has been an effort, not so much to work out specific differences for all species within given genera, as to disclose whether or not such characters do exist in the females.

A second important aspect of the problem has been an attempt to establish on the basis of the female genital structures some conclusions concerning the phylogenetic relationships between the various mirid genera and higher groups. The generic classification of the Miridae, perhaps more than any other heteropterous family, is in a somewhat unsatisfactory condition. Numerous genera have been
founded upon the most superficial characters. Therefore, it was felt that a study of the female genital structures might throw light upon some of these generic relationships, and indicate where more intensive future work is needed. Perhaps from the "long view" this has been the most important aspect of the problem.

The size of the family Miridae has made it impossible to cover more than a very small percentage of the species and only a portion of the genera. It has been the intent of the author to open new lines of investigation rather than to attempt to work out in detail any single group. Major emphasis has been placed upon the subfamily Capsinae as restricted by J. Sahlb. (1920), Bergroth (1922), and Knight (1923), with lesser attention being given to some of the other subfamilies.

Fortunately, the recent series of excellent papers by Dr. Bertil Kullenberg of Sweden has furnished terminology for some of the structures under investigation. Kullenberg's work is of the highest merit, and without it this investigation could hardly have been brought to its present form. However, a number of Kullenberg's names are essentially descriptive and rather lengthy for taxonomic usage. Therefore, letters have been used frequently during this investigation to designate the various morphological parts involved. This use of letters rather than names has seemed advisable in view of the almost complete lack of knowledge of the functions of the
various parts. At the present time to assign names to the parts would add new terminology to an already unwieldy mass of morphological terms, and the terminology would almost certainly be superseded as the functions of the structural parts become known.

Two areas of the bursa copulatrix have been used in the present study. First, the sclerotised rings found on the dorsal wall of the bursa, and second, the sclerotised portions of the posterior wall with its attendant sclerites. These structures appear to be of the highest taxonomic and phylogenetic value. In most cases investigated not only do they seem to be of great value in establishing generic, tribal, and subfamily relationships, but they are often of great value in specific separation. Frequently the female parts show more striking differences than do the harpagones of the males (see Lygus discussion).

Primary attention was given to the two structures mentioned above for several reasons. First, structures to be of general taxonomic value should be as readily available for study as possible and not require special and difficult techniques in preparation. Because of their relatively strong sclerotization, the sclerotised rings and the posterior wall can be dissected for study in a very short time with only a little practice. Secondly, they appeared upon preliminary investigation to show considerable differentiation even within closely related groups. Thirdly, to cover even the limited ground surveyed in this study, it was necessary to limit the
number of characters used. Since one of the essential premises in undertaking the study was to determine whether or not taxonomically useful characters are present, the adoption of two readily usable structures seemed the most practical approach, and the one to most effectively answer the unknowns for which the study was initiated. Undoubtedly good characters exist in the vulvar area of the female genitalia, and it would be most interesting to see if the ovipositor blades could be used to define species and higher groups in this family.

It is the hope of the author that this preliminary study will serve as the impetus whereby more detailed studies upon genera and generic-complexes will be made, with the result that the phylogeny of the Miridae may be more adequately known, and the correct determination of the species may be as readily accomplished by the use of the female sex as is possible today by the use of the male.
REVIEW OF LITERATURE

The review of literature presented here deals with important papers concerning the female abdomen of the Hemiptera in general, as well as those papers concerned entirely, or in part, with the Miridae.

Dufour (1833) published a large work upon the reproductive structures of Hemiptera. This paper is principally concerned with the "inner" sexual structures such as the ovaries and testes. No mention is made of the sclerotized rings and the posterior wall of the bursa copulatrix, the structures used in the present paper.

In 1849 Lacaze-Duthiers published upon the genital armature of the female insect, and this was followed by comparable studies by Packard (1868) and Eaton (1868).

Verhoeff in 1893 published a work upon the abdominal segmentation of the Hemiptera. This paper attempts to interpret the homologies of the segments of the hemipterous abdomen. The paper contains no illustrations.

Peytoureau (1893 and 1894) contributed studies of the terminal segments and genital armature of the Hemiptera and other orders.

Heymons (1899) studied the hemipterous abdomen and interpreted the homologies of the abdominal segments from an embryological standpoint.
Newell in 1918 studied the genital structures of the Hemiptera. The Miridae are not treated in this paper. A large bibliography is included.

Ekblom in 1926 and in 1930 published results of studies on the morphology and biology of several families of Hemiptera. These papers deal with mouthparts and other anatomical structures, and include a section on the genital apparatus.

Ludwig (1926) published a paper that is concerned primarily with the functions of the copulatory apparatus during copulation. In this paper the Miridae are not treated.

Esberday (1931) published a work on the physiology of the genitalia and related structures. This paper includes a number of Hemiptera, but again the Miridae are not discussed.

In 1933 Snodgrass discussed the hemipterous abdomen. The work is concerned primarily with the terminology and homology of the segments involved in the female egg-laying and copulatory apparatus. The Miridae are not discussed in the paper.

Snodgrass (1935) reviews his earlier work on the hemipterous abdomen and adds some additional information. Both of these papers contain a number of illustrations.

In 1936 Larsen published a paper dealing with the morphology of the abdomen in the aquatic and semi-aquatic Hemiptera. This paper discusses the functional relationships of the parts during copulation.
and includes biological material on a number of species.

A number of notes exist in the works of various authors concerning individual species of Miridae. No attempt has been made to survey all such information, but the following may be cited: Fulkert (1930), Johnson (1932), Lindberg (1939), Painter (1930), Petherbridge and Thorpe (1928), Roberts (1950), Silvestri (1932), and Wegrzecki (1930). In addition, Galliard (1935) working with the Reduviidae and Larsen (1936) with Corus, among others, present information of interest.

A considerable volume of taxonomic work exists that deals with the genital structures of the Miridae. In such papers, descriptions and illustrations are largely confined to the harpagones (claspers) of the male sex. Among such papers are the numerous works of Knight, Reuter, Van Dusee and Wagner.

In 1925 Singh-Pruthi published a treatise on the male genitalia of the Hemiptera. This paper is comparative in nature and deals with a number of species of Miridae. The paper contains a large number of illustrations.

Eullenberg (1946) presented a paper on the biology of a number of species of Swedish Miridae. The paper discusses the female genitalia in regard to the morphology and functions of the structural parts. It includes biological information and contains a large number of illustrations. A review of literature is included.
Kullenberg (1947a) published a work on the morphology and functions of the male and female genitalia. This paper assigns terminology to a number of structures used in the present study. A series of plates are included that illustrate the various conditions found in the female genital structures.
MATERIALS AND METHODS

The methods, materials, and techniques used during the course of this investigation have not been extensive, or complicated, or have they differed appreciably from those used in other genitalic studies.

In preparing for study pinned, or pointed, material the specimens were placed in a relaxing chamber for twenty-four hours to soften the body parts. Then the entire abdomen was removed from the specimen. This was accomplished most efficaciously by placing the specimen upon a paraffin block consisting of two strips of wood, or cork joined at right angles. This paraffin covered structure enabled one to orient a specimen at almost any angle desired. Specimens from which the abdomen was to be removed were placed with the point of the pin in the vertical board at such a height and angle that the head of the pin rested firmly in the paraffin of the horizontal board. To remove the abdomen best results were obtained by placing a dissecting needle firmly upon the ventral side of the base of the abdomen and exerting downward pressure with a second needle placed upon the dorsal surface of the abdomen near the apex.

When the abdomen had been removed from the body of the insect it was placed in a five per cent solution of hot potassium hydroxide, which in a short period of time cleared away extraneous material and
left the sclerotized portions readily discernible. Hot potassium hydroxide was found preferable to a cold solution due to the great variation in the degree of sclerotization found in the various species of the family. Species with strongly sclerotized structures must receive a longer period of clearing than those with delicately sclerotized parts. Teneral specimens are entirely unsatisfactory material for study purposes. In a cold solution it was more difficult to regulate the necessary period of clearing and often led to destruction of necessary structures in the more delicate species. With a hot solution specimens could be checked several times during the clearing process within a relatively short period of time. However, once the time necessary for clearing a given species is known, the cold preparation is perfectly satisfactory.

Species cleared in potassium hydroxide were then removed to a Syracuse watch glass containing water and dissected. The holders used by the watch repair trade have proven to be excellent for holding dissection needles. These instruments give good leverage and hand control while firmly holding minuten nadeln pins which serve nicely for dissecting needles.

The dorsal wall of the abdomen was first dissected away and then the sclerites of the ventral wall. It was found necessary to dissect away various membranous portions in order to clearly expose the sclerotized rings of the bursa copulatrix and the posterior wall,
particularly for purposes of making drawings. After the external abdominal sclerites had been removed the next step was to separate the anterior ovipositor blades, with their attendant structures, from one another. This was found to be most easily accomplished by placing the specimen with the ventral surface uppermost and then inserting a dissecting needle between the first and second fibulae at the point where they make an abrupt caudal turn near the base of the ovipositor blades. The needle was then pulled firmly and carefully in an anterior direction and the process repeated upon the opposite side. This freed the anterior ovipositor blades, the sclerotized rings of the bursa, and attendant structures from the posterior ovipositor blades, the ovipositor sheath and the posterior wall of the bursa that lies between the bases of the above structures. For purposes of illustration it was necessary to dissect the posterior wall away from the posterior ovipositor blades and the ovipositor sheath, a process sometimes rather difficult to accomplish without damage to the structures desired for study in the smaller and more delicate species.

After dissection and study the parts were placed in a small vial containing seventy per cent ethyl alcohol together with a code number which corresponded to a duplicate number placed upon the pin holding the specimen from which the abdomen had been removed. Later the genitalia parts were placed in tiny vials containing glycerine, and attached by their corks upon the pin holding the specimen.
For making drawings the genitalic portions were oriented upon celluocotton in water or alcohol. The illustrations were made with use of a squared ocular under a Spencer dissecting microscope using eighty-five magnifications. Dissection was also accomplished with a Spencer dissecting microscope using twenty-nine magnifications. All illustrations have been prepared on the same scale. The posterior wall of the bursa copulatrix has been illustrated from a caudal view, except where otherwise indicated. All illustrations of the sclerotized rings have been made from a dorsal view.
DISCUSSION OF THE FEMALE ABDOMEN

No critical study of the segmentation of the female abdomen and the morphological relationships of the parts has been made. The following brief discussion is taken primarily from Snodgrass (1933 and 1935) and Kullenberg (1946 and 1947a) and is intended merely to orient the reader as to the location of the parts involved in the taxonomic discussion. A rather complete morphological discussion of the segmentation of the abdomen and the parts involved in the abdomen of the *Miridae* may be found in the above mentioned works of Kullenberg.

In order to understand the position of the main structures used in this paper it is necessary to have knowledge of the segmentation of the abdomen of the female mirid. This is particularly true with respect to the terminal segments which are highly modified for copulation, insemination and egg deposition.

The heteropterous abdomen is composed of eleven segments with a telson present embryonically, but absent in the adult insect, (Heymons 1899). The genital segments of the female are the eighth and ninth (Snodgrass 1933, Kullenberg 1947a), however, adjacent segments are also somewhat modified to accommodate the great specialization of the genitalia.
The shaft of the ovipositor is composed of four blades, or valvulae, (Snodgrass 1933). Two of these, the posterior pair have a dorsal and internal position and are united at the base, (Plate I, Fig. 2). The other two, the anterior pair, have an external and ventral position, (Plate I, Figs. 1 and 3). The posterior valvulae belong to the ninth abdominal segment, while the anterior ones are part of the eighth segment. Distally the valvulae are expanded into "spear-shaped" tips armed with strong teeth on their margins for cutting into plant tissues at the time of egg deposition. The anterior valvulae are usually less heavily sclerotized than the posterior pair. For a discussion of the functional movements of the valvulae see Eullenberg (1946).

From the proximal end of each valvula proceeds a slender sclerotized band. These bands are the fibulae of Verhoeff (1893), shanks of Ekblom (1926), and rami of Snodgrass (1933), (Plate I, Figs. 1, 2, 3). The rami of the anterior valvulae curve sharply along the anterior margins of the posterior rami and become attached by sclerotized rods, the connecting pieces, (Plate I, Figs. 1 and 3), to the upper end of the transverse ridge of the ninth tergum. The posterior rami are attached to the anterior ends of the second valvifers (Snodgrass 1933), or ovipositor sheath (Eullenberg 1946), (Plate I, Fig. 2). The first valvifers are rather indistinct and poorly developed in the Miridae.
The bursa copulatrix, (Plate I, Fig. 3), is an invagination between the eighth and ninth segments on the ventral side of the body. It is fastened to the rami and the proximal ends of the connecting pieces.

The first structures used in this study have been the sclerotized parts of the posterior wall of the bursa (Kullenberg 1947a), which lies between the posterior rami and is attached laterally to them and to the bases of the posterior valvulae, (Plate I, Fig. 2). This posterior wall is considered by Kullenberg to pertain to the ninth segment.

The second structures used have been the sclerotized rings found on the dorsal wall, or roof, of the bursa, (Plate I, Fig. 1). They may be flat ellipses, circles, etc., formed by strongly sclerotized rings of the integument, or they may be curved and twisted in various manners. The rings are paired and bilaterally symmetrical in most of the species studied. The area in which these rings occur is considered by Kullenberg to pertain to the eighth abdominal segment.
The family name Miridae has been the subject of considerable controversy. This resulted from a basic difference in nomenclatorial concepts regarding whether a family name should be derived from the name of the oldest included genus, or from a priority standpoint involving the first use of the name. Parshley (1915) has pointed out however, that the family name Miridae has precedence on both points, Miris Fabr. 1794, being the oldest included genus, and Mirides Hahn 1831, being the earliest name given to the family. In view of this, the author is unable to account for the use of Capsidae as the family name by Kullenberg in his recent papers, other than the fact that the name Capsidae has been in general use among European workers.

Several of the older authors, notably Fieber (1858 and 1861), Thomson (1871), and Douglas and Scott (1865) have suggested schemes of classification of the family Miridae. However, the present groupings within the family originate in the works of O. M. Reuter, particularly in his treatise of 1910. In this contribution Reuter recognises nine subfamilies of Miridae from the world.

In 1916, Van Dusee changed Reuter's Heterotomaria to Orthotylinae and his Macrolopharia to Dicyphinae and changed the nomenclature of several tribal names.
J. Sahlberg (1920), Bergroth (1922), and Knight (1923) have raised Reuter's tribe Mirini of the subfamily Capsinae to subfamily rank. Knight (1943) erected the subfamily Hyalodinae to include the genus Hyaliodes and several Neotropical genera.

China (1945) published a rather controversial paper on the generic names of the British Heteroptera. This paper uses Opinion 31 of the International Commission on Zoological Nomenclature to reject the Fabrician method of genotype designation, and attempts to fix the next valid type designation. This procedure causes a few rather drastic nomenclatural changes in the family Miridae. For example, the genus Capsus, subfamily Capsinae, takes as type a species now included in the subfamily Orthotylinae, thus eliminating the name Capsinae as a valid subfamily name. The nomenclature adopted by China has not been used in this paper for the following reasons: First, because it is clearly beyond the scope of this paper to enter into controversial nomenclatural problems. Second, China's paper deals only with British genera, and, if his changes were adopted here, it would be logically necessary to investigate the genera used in this study that are not included by China, to ascertain whether or not they are subject to the same modifications. Such a procedure is considered beyond the scope of the present study.

Each case in which the name used in this paper deviates from that used by China is indicated under discussion of the individual
gentus concerned. The decision not to use the modifications proposed by China is not to be construed as an indication of the author's disagreement with the conclusions reached by China. Since the author has not investigated the nomenclatural and interpretive points involved, he is not in a position to pass judgement upon the validity of the changes proposed in the paper under discussion.

The subfamily names used by China and the equivalent terminology used in this paper are as follows: China's Mirinae includes the Caprinae and Mirinae of the present paper. His Bothynotinae is equivalent to the tribe Bothynotini of the subfamily Clivininae, Cylleorinae equals Orthotylinae, and Plagiognathinae equals Phyllinae.

The characters used in separating the Miridae into subfamilies have been primarily the nature of the arolia, the condition of the hamus of the wing, and the male genital structures. These last have been introduced particularly by Knight (1923). In that paper Knight mentions the fundamental nature of the genitalia in the phylogeny of the Miridae, but does not indicate what characteristics of the genitalia serve to place a given species in a particular subfamily.

Kullenberg (1947b) discusses the philosophical implications of structures used to establish phylogenetic relationships. His conclusions are based upon what to the writer seem to be very solid grounds. Kullenberg believes that structures which are highly plastic, in being influenced by mutations, are not reliable criteria upon
which to establish phylogenetic systems. Conversely, those structural areas which are relatively resistant to adaptational change are to be considered as of the highest value. For example, Kullenberg believes that the male copulatory structures, which have the single function of inseminating the female, are likely to respond to mutations without impairment of their function, whereas the female genitalia which have a three-fold function; the coupling of the male penis, the receipt and retention of the male products, and service in the process of egg-laying are less likely to undergo rapid and extreme modifications, because of the equilibrium set up by the functional needs of the three activities. For this reason, Kullenberg concludes that the forms of the female genitalia are of extreme importance for the establishment of phylogenetic relationships.

Kullenberg indicates that Bothynotus pilosus and Dicyphus constrictus appear to be closely related and rejects the subfamily Bothynotinae, established for Bothynotus. He believes that the vestiture of the wing membrane constitutes a very superficial character upon which to found a subfamily group. Further, he considers that the Mirinae do not constitute a distinct subfamily, but only a tribe of the Capsinae.

Another viewpoint elucidated by Kullenberg is his rejection of the tarsal arolia as structures of high phylogenetic value. He
feels that these structures are highly adaptable and functional and that they are not nearly so basic for establishing relationships as are the genitalia of the females.
The structures of the bursa copulatrix used in this study have hitherto been named only in part. Kullenberg (1947a) gives descriptive names to a number of the parts, and some of his names have been adopted in the present paper. In other cases, length of the names or inappropriateness has caused the writer to use other symbols to replace the Kullenberg terminology. With regard to the small parts that form the posterior wall of the bursa no terminology has been available. Since the functions of these minute structures are unknown, as mentioned in the introduction, the author has hesitated to arbitrarily assign descriptive names to them and further complicate the already unwieldy terminology of entomological morphology. Therefore, a system of letters has been adopted and used where the part under discussion does not possess a name, or where the name has appeared to the writer to be inappropriate.

The rings found on the dorsal wall of the bursa copulatrix are called throughout this paper the sclerotized rings. Kullenberg (1947a) designates these rings chitinshlingen. Adjacent to these sclerotized rings one can often observe differentiated areas that are more heavily sclerotized than the surrounding membrane. This condition is particularly well developed in the subfamily Capsinae. The sclerotized region lying immediately anterior to the rings is
designated as structure F (Plate III. Fig. 11). This region assumes various shapes and degrees of sclerotization, and often appears undifferentiated from the adjacent membranes. A second adjacent sclerotization is often present laterad of the rings. This sclerotization curves below them and appears to lie at an angle. This sclerotization has been designated as structure G, (Plate III. Fig. 11), and perhaps represents the anterior margin of the dorsal sack. (see Hullenberg 1947a). Like structure F, this G sclerotization may be variously differentiated. Where the sclerotization around and near the rings is undifferentiated it has been designated under the general term, adjacent sclerotization.

The posterior wall of the bursa copulatrix appears to be very important taxonomically. The position of this posterior wall in relation to the adjacent structures is somewhat variable. It may lie dorso-ventrad, or cephalo-caudad, or, very often, it assumes a position somewhat intermediate between these two planes. For purposes of uniformity and clarity of description it has been necessary to arbitrarily consider each species as having the posterior wall lying in a dorso-ventral plane. This orientation has been followed throughout this paper. In the Capsinae, in particular, the posterior wall possesses a number of unnamed parts. In the majority of species studied the most conspicuous element consists of a pair of wing-like sclerites that diverge from the mid line, generally curve in a dorso-lateral direction, and taper to the dorsal tips. In certain species
these wing-like structures are the only features present on the posterior wall. Often they are fused into a single piece on the median line, but primitively they probably were paired. (see Phylinae discussion). These wing-like structures are designated as the A structures in this paper (Plate II, Fig. 24).

In the Capsinae and Mirinae a prominent mesal thickening occurs on the posterior surface of the posterior wall. This thickening may be in the form of a simple bar, or rod, or it may assume a variety of twists and curves. It has been designated structure B (Plate II, Fig. 24). Frequently structure B extends considerably dorsad of the dorsal margins of the A structures and is recurved cephalad to terminate in a wide button-like flange. This wide terminal flange has been designated as structure C, (Plate II, Fig. 24). Structures B and C are equivalent to the chitinknopfchen of Kullenberg. The letter D has been given to an area lying dorsad of the dorsal margins of the A structures and between the tips of A. Usually the D area is membranous but may present various foldings and thickenings that are occasionally useful for purposes of description, (Plate II, Fig. 24). Two thin flaps, or folds, often arise from the dorsal margin of the A structures and extend as broad rounded lobes in an antero-ventral direction. These lobes are designated as the E structures, (Plate II, Fig. 24). In certain of Kullenberg's figures these lobes are designated as the weiche falte. In some species of Capsinae a pair of variously shaped lobes arise
near the dorso-lateral tips of the A structures and extend mesad. These lobes are designated as the H structures, (Plate II, Fig. 24).

In the subfamily Orthotylinae the posterior wall is so greatly modified that it has seemed necessary to adopt different letter designations even though the various structures are probably, in some cases, homologous to already designated structures in other subfamilies. The posterior wall in this subfamily sometimes lies nearly cephalo-caudad, but, for the sake of uniformity, the descriptions have been written with the posterior wall oriented on a dorso-ventral plane. In contrast to the Capsinae, the anterior surface of the posterior wall appears to offer the best taxonomic characters in this subfamily. Two large rounded lateral lobes are present that are perhaps homologous to the A structures found in other subfamilies. These paired lateral lobes have been designated the J structures, (Plate VI, Fig. 15). Arising from the dorsal margin of each J structure and extending ventrad is a flange usually with one or two finger-like projections. These flanges may be homologous to the E structures of the Capsinae. They are designated as the K structures in the present paper (Plate VI, Fig. 15). These K structures are equivalent to the sklerotisierte Falte of Kullenberg. Between the J structures there is usually present a more or less prominent single sclerite, or median lobe, that here is designated structure L (Plate VI, Fig. 15).
In the individual descriptions to follow the sclerotized rings and adjacent structures have been described first. Measurements for their maximum lengths have been from the anterior edge of the adjacent sclerotization to the posterior edge of the ring margin. This method of measurement is somewhat unsatisfactory for comparative purposes, as the adjacent sclerotization is sometimes rather indistinct. Furthermore, it gives no real idea as to the actual size of the ring. Maximum width of the sclerotized ring area has been considered to be from the lateral edge of one ring margin to the lateral edge of the other ring margin. This measurement is perhaps of more comparative value than the maximum length figures.

In all cases the description of the posterior wall follows that of the sclerotized rings. Measurements have been as follows: Maximum length is considered to be from the most ventral point along the ventral margin to the most dorsal point along the median line; the maximum width measurements have been made across the dorso-lateral tips of the A structures (J structures of the Orthotylinae). All measurements are given in millimeters or fractions thereof.
The present study includes material from eighteen tribes in nine subfamilies. The subfamily Capsinae has been subjected to the most intensive investigation. The other subfamilies have been studied less intensively, but a selective attempt has been made to study species representing as many tribal groups as practicable.

The evidence at hand suggests that the subfamily distinctions recognized by Reuter and Knight are generally in agreement with the relationships indicated in the female genital parts studied. However, in a number of cases, the amount of material studied has not been sufficient to draw more than the most tentative conclusions. In other cases, certain genera show characters that indicate an intermediate position between two subfamilies. In a few genera the present taxonomic position does not appear to be in accord with the evidence offered by the genital structures studied.

The question of what constitutes a primitive or generalized condition in the female genital structures of the Miridae is, of course, rather hypothetical at the present stage of knowledge.

The subfamily Bryocorinae is considered here to show the most primitive type of genitalia (sclerotized rings and posterior wall). In this subfamily the rings are absent and the posterior wall is entirely membranous. The Phylineae and Dicyphinae likewise present a
rather generalized picture. The selerotized rings, in most cases, are simple ellipses with generalized, poorly differentiated adjacent selerotization, (Plate V. Fig. 16). The condition of the posterior wall in these two subfamilies is most significant. It consists of a pair of simple selerites, which are considered to be homologous to the A structures of the more specialized subfamilies (Plate VI. Fig. 7). In the Phylinae and Disymphinae the selerites are usually surrounded by undifferentiated membrane. These selerites taper dorsad to end in a blunt point. In a number of the phyline genera the lateral margins of the selerotized rings plus the adjacent lateral selerotizations are somewhat curved dorso-mesad and appear to presage the greatly infolded condition so characteristic of what are considered the typical orthotyline genera. The relationship of the Phylinae to the Orthotylineae is further evidenced by the seemingly annectant position of the orthotyline species Semium hirtum Reuter. This species possesses a posterior wall very similar to the type possessed by the Phylinae. It consists of two simple diverging and tapering A structures, (Plate VI. Fig. 11). The selerotized rings of S. hirtum, while more infolded on the lateral margins than are those of any of the Phylinae, nevertheless, present a much less specialized condition than do the other Orthotylineae.

The recently erected subfamily Hyaliodinae has selerotized rings rather different from those of any other species studied, but suggestive of the twisted condition of the Deracocrininae, (Plate V. Fig. 8).
The posterior wall, however, is of the same type as that found in the Phylinae and Dicyphinae. Only one species of this subfamily has been investigated so that considerably more study must be undertaken before any real statements can be made of the subfamily relationships.

The Deraeocorinae is a somewhat anomalous group that seems to present conditions more specialised than the preceding subfamilies. In this subfamily the sclerotised rings, (Plate V. Fig. 15), are considerably twisted and curved. The posterior wall, (Plate VI. Fig. 10), is one simple sclerite rather than consisting of two distinct sclerites as in the preceding subfamilies. In Deraeocoris histrio Reut., (Plate VI. Fig. 8), the ventro-mesal area of this plate possesses a thickening. This thickening is suggestive in a generalised way of the structures found in the Capsinae and Mirinae. One may suggest that possibly the posterior wall of the Deraeocorinae is the type from which the more specialised walls of the Capsinae have arisen.

On the other hand, the rather complicated nature of the sclerotised rings suggests the possibility that the Deraeocorinae represent extremely specialised forms in which the posterior wall illustrates a secondarily simplified condition.

Extremely close relationships between the Clivininae and the Deraeocorinae are indicated by the appearance of both the posterior wall and the sclerotised rings. Indeed, it is doubtful whether these groups should be considered distinct subfamilies. However, here again a study of more genera and species is needed before definite
conclusions can be drawn. Certain of the Orthotylineae in the
tribe Haliscini show affinities relating them to the Derasoecorinae
and Clivineminae. Orthocephalus mutabilis Fall., in particular,
has a posterior wall very similar to that present in Largidea
rubida (Uhl.), (Plate VI. Fig. 2), and the sclerotized rings show
twisting and looping quite unlike those of the other Orthotylineae.

The subfamily Orthotylineae is probably not a homogeneous
phyletic group. As mentioned above, the subfamily shows relationship
to the Phylineae and Diophylineae on the one hand and to the
Derasoecorinae and Clivineminae on the other. The more characteristic genera show a highly infolded condition of the lateral margins of the sclerotized rings, so much so that in some genera it is
difficult to see the ring margins. In these genera the posterior wall is exceedingly specialised and of quite a different nature than that found in any other subfamily. Two large lateral lobes are present (J structures) and each of these bears on its anterior surface a large appendage-like flange, (K structure). This K structure is not present in any other subfamily studied and appears to the writer to be of great importance in defining this subfamily. Often a median lobe (L structure) is present between the large J structures. Probably these J structures represent the A structures of other subfamilies. The extreme specialisation of the posterior wall in the Orthotylineae makes conclusions as to the homologies necessarily tentative at the present time. However, the characters
found in the female genitalia indicate that the Orthotylinae and Capsinae represent the most specialized of the Miridae and that they are related through other subfamilies rather than directly to one another. The apparent heterogeneity of certain genera at present included in the Orthotylinae makes conclusions on their taxonomic position extremely difficult to understand.

The remaining two subfamilies, the Capsinae and Mirinae, undoubtedly are very closely related. Various of the older authors have considered them as representing a single subfamily group, and recently Kullegenberg (1947b), after a study of the female genitalia, has regarded them as a single subfamily. China (1943) likewise places them together as a single subfamily. The present author is inclined to agree with the viewpoint that a single subfamily is involved, although certain differences can be noted between the species of Mirinae and Capsinae studied. However, these differences are no greater than differences between groups of genera within the subfamily Capsinae and, therefore, it is impossible on the basis of these studies to contribute evidence in favor of maintaining the two groups as separate subfamilies.

The female genital parts studied indicate that the Capsinae represent a very specialized group. This is particularly true of the posterior wall which is composed of wing-like divergent, dorsally tapering A structures that mesally have a strongly sclerotized area. Dorsally this area is usually strongly looped and twisted, (Plate II. Fig. 24). The tips of the A structures often show mesally curving
sclerites (H structures). In general, the posterior wall presents a wealth of taxonomic characters and is of a highly complex nature (see discussion under subfamily heading). The sclerotized rings are rather simple and consist of ovoid elliptical lobes. The adjacent sclerotization is considerably differentiated and at least two distinct areas of sclerotization can be traced from genus to genus. Since this subfamily has been much more intensively studied than any of the other subfamilies it is perhaps impossible to compare the results with those noted above for other groups. Nevertheless, the fact that a basic morphological pattern has been found to be present through the subfamily certainly strengthens the admittedly fragmentary evidence obtained for the preceding subfamilies.

In conclusion one may say that the female genital structures used in this study appear to have real worth in attempting to understand the phylogenetic relationships of the higher categories in this family. While the present study is only an introduction to the problem, it seems possible to interpret certain relationships and degrees of specialization that throw considerable light upon these higher categories.

A tremendous amount of future work will be needed upon these structures before the validity of the generalizations proposed here can be evaluated. Also, it will be necessary to test the evidence derived from these genital structures against other morphological, biological, and physiological criteria.
Subfamily Capsinae Reuter 1883

This is a very large subfamily containing thousands of species in many genera. It includes some of the largest and most spectacular of the Miridae, as well as a number of genera of great economic importance.

Particular attention has been paid to this subfamily in the present study for a number of reasons. First, the subfamily contains a sufficiently large number of genera and species to make the availability of material a matter of secondary importance, and to allow for sufficient diversity to enable one to evaluate the potential importance of these female parts as taxonomic criteria. Secondly, the Capsinae, at the outset, appeared to represent a more homogeneous group than any of the other large subfamilies. Therefore, one might reduce to a minimum the possibility of becoming involved in the problem of the correct disposition of a given species in regard to its present subfamily position. Finally, and by no means of lesser importance, was the fact that the majority of the species were of relatively large size and heavy sclerotization. This condition allowed dissection to be accomplished more readily and considerably facilitated the interpretation and study of the genitalie parts used in this investigation.

The present investigation has included the study of fifty-eight species of Capsinae. These species represent thirty-three genera and
two of the three tribes comprising the subfamily. Material repre-
senting the tribe *Myrmecorini* has not been available to the author
for dissection purposes.

In general, the *Capsinae* appear to constitute a fairly compact
group. With only a few exceptions the species follow a general
pattern. As might be expected, a few species illustrate questionable
situations where the affinities cannot be determined without con-
siderably more material at hand.

The sclerotized rings, (Plate III. Fig. 11), consist, in most
cases, of a pair of more or less ellipsoidal, or ovoid, rings that
have strongly sclerotized margins and are not infolded on the lateral
margins as in some of the other subfamilies. In *Garganus fusiformis*,
(Plate IV. Fig. 10), the rings are represented only by a pair of bars,
or rods, with no central area. This is considered to be a secondary
specialization resulting from a fusion of the anterior and posterior
ring margins. The posterior wall of the bursa of this species is of
a conventional type for the subfamily. In *Polymerus basalis*, (Plate
V. Fig. 4), the rings have joined on the midline and become a single
structure rather than a pair of rings. This species is also very
interesting in that the posterior wall, (Plate III. Fig. 5), is
composed of a pair of narrow diverging A structures fused on the
midline, but lacking the B, C, and E structures so characteristic
of the other *Capsinae*. With the exception of these two species all
the other species studied present paired rings, although in a few
genera a sclerotized mesal connection exists across the midline, (Plate IV. Fig. 1). The sclerotized rings are sometimes very valuable in separating species and genera, but, in general, they appear to be less useful for distinguishing the groups within the subfamily than are the characters found on the posterior wall.

The posterior wall of most of the Capsinae is a highly differentiated and specialized structure. It appears to offer excellent characters for subdividing the subfamily into natural groups. This wall consists of a pair of wing-like A structures usually meeting on the meson, where the posterior surface possesses a very strongly sclerotized area (structure B). This B structure usually extends dorsad and curves anteriorly to end in a widened flange, or C structure. Two semi-membranous folds arise from the dorsal margins of the A structures and extend ventro-cephalad of them. These are designated the E structures and are possibly homologous to the K structures of the Orthotylinae. From the dorso-lateral tips of the A structures variously shaped sclerites arise and extend mesad. These are designated as the H structures and are lacking or entirely membranous in many genera. In Neolygus, (Plate II. Fig. 9), these H structures are greatly enlarged and exceed the A structures in size.
The majority of genera of Caprinae investigated fall into five main groups on the basis of the appearance of the posterior wall. These five groups are not equal in rank and certainly not equal in homogeneity. Several of them can certainly further be broken down and at least in one case the group is probably an assemblage of genera having no truly close relationship. They are placed together in this paper primarily as a matter of convenience.

The first of these groups includes the genera Neoborus, Xenoborus, and Tropidosteptes. These three genera are very closely related and probably represent a single genus (see generic discussion). The complex is quite distinct from any of the other caprines studied. It possesses large H structures that bear tubular evaginations that arise from the anterior surface and extend ventrad. The ventral margin is very deeply emarginate mesad. The B structure is absent or represented only by a minute thickening placed on a median extrusion of the A structures. (Plate I, Fig. 7).

A second group includes the genera Neurocolpus, Parasalocoris, Lampethusa, and Posas. Like the preceding, this complex is a very compact and well defined unit. The posterior wall has the B structure reduced to a small plate that does not reach the dorsal margin of the A structures. The A structures themselves are produced dorso-mesad and probably serve the functions of the B and C structures in other genera. The H structures are absent, (Plate I, Fig. 17). As in the preceding group the relationships of the various genera to
one another are so close as to make it doubtful whether separate
generic recognition should be accorded the species. *Stitucapsus*
franeri*ae* Kngr. has a posterior wall that shows some resemblance
to this group. However, it is of somewhat different composition,
and the sclerotized rings are of a different nature, whereas in
the other four genera the shape of these rings is nearly identical.
Both of the above groups are discussed more fully later in this
paper.

A third group of species includes the genera, Bolteria, and
*Diochrooscytus*, and perhaps Capsus. This group is characterized by
having the A structures separated from the B structure by a delicate
membrane rather than being fused to it as in most of the other
genera of the subfamily, (Plate II. Fig. 3). In *Bolteria* and
*Diochrooscytus* the B structure is narrow and tapers to a ventral
point, (Plate II. Fig. 1). In *Capsus* ater a broad mesal area is
present that possesses a narrow, dorsally projecting rod, (Plate
II. Fig. 2). It is not clear whether this entire mesal area repre-
sents the B structure, or whether the latter is represented only by
the dorsally projecting rod. *Capsus* also possesses a different
type of sclerotized ring from that shown by the other two genera.
In *Diochrooscytus* and *Bolteria* the sclerotized rings are connected
mesally by a sclerotized bar that is connected to the mesal margin
of each ring, (Plate IV. Fig. 3). In *Capsus* the rings, (Plate IV.
Fig. 6), are not connected by a mesal bar but are of the conventional type.

The fourth group of genera within the subfamily is a large one and is a more heterogeneous assemblage than are the three preceding groups. This fourth group is composed of the following genera: Phytoecoris, Lygus, Platypus, Calocorisa, Poeillocapsus, Lygides, Gargamus, Horcias, Cocobaphes, and possibly Neozygus. This group is characterized by having the portion of the B structure that lies between the A structures form a flattened disc, (Plate II, Fig. 26). This disc is usually tilted caudal from the ventral to the dorsal margin. In the majority of these genera the H structures are prominently developed, although they are apparently absent in Phytoecoris and the subgenesis Apolygus. The size and relationship of the disc of structure B to the margins of the A structures has proven very useful in the preparation of the generic key that follows this discussion.

The fifth group recognizable within the subfamily almost certainly does not represent a natural group of species. When more material has been investigated this group of genera will probably be separable into two or more sections. This aggregation is not in the same category as the preceding four groups, and perhaps the most one can say by way of definition is that it includes species with rather conventional types of posterior walls and sclerotized rings that do not fall within the preceding categories. This group at present is considered to include the following genera: Adelphocoris.
Pantilius, Calocoris, Euchilocoris, Irbisia, Thyrillus, Platytylellus, and Opisthauria. The group may be characterized as having the B structure always extending dorsad of the dorsal margin of the A structures, and this B structure always lacking a true disc as is present in the preceding group. Irbisia and Thyrillus probably represent a distinct group. The peculiar characteristics of these two genera are discussed in the descriptive section of this paper.

The genus Neolygus has rather conventionally shaped sclerotized rings, (Plate III, Fig. 9), but the posterior wall is very greatly modified, (Plate II, Fig. 9). The H structures are tremendously developed and are much larger than the A structures. A small disc-like B structure is present near the dorsal margin of the A structures. This disc-like B structure probably shows a definite relationship to group four above. However, the genus shows such great modifications that much more information must accumulate before its true position can be ascertained.

The genus Stenotus appears to be quite distinct from any of the other capsine genera. Both the posterior wall and the sclerotized rings are of distinct types. If this genus has any close relatives within the subfamily they have not been represented among the genera studied during this investigation.

The species studied do not illustrate any characters that will serve to separate the Resthenini from the Capsini. The three genera
of Resthenini observed have genital characters that are much more similar to some of the genera of Capsini than are several genera of Capsini to one another.

The phylogenetic position of the Capsinae within the family Miridae is extremely interesting. The female genitalia, as mentioned in the general subfamily discussion, indicate a highly specialised condition. Together with the Orthotylinae this subfamily is probably the most highly developed of any of the mirid groups. The Deraeocorinae are possibly the group from which the Capsinae have developed. This is suggested by the condition of the posterior wall which is a simple plate in the deraeocorines, but in a generalized way in some species shows a condition from which the more specialised Capsinae could easily have developed.

The female genitalia of this subfamily appear to offer very good characters for recognizing groups of genera within the subfamily. These structures also appear to offer very excellent characters for the definition of genera, and indicate that in some places the generic limits, as recognized at the present time, are rather unsatisfactory. A study is needed of all the species of a genus to ascertain whether or not specific characters will prove to be present in these genitalic structures. On the basis of present evidence it does appear that these structures will prove to be of considerable value in the specific determination of many species.
The following key is prepared at the present time to indicate characters that appear to be of value in separating the Capsinae into groups. It is extremely incomplete in that only a small portion of the genera are included, and of these only a few species of each have been studied. The intent has been to use this for future work, and workers, to test, change, clarify, or corroborate, as the case may be, when more studies have been made of the important characters found in the genitalia of the female Miridae.

1. Sclerotized rings connected with one another mesally by a sclerotized bar formed by the coalescence of the margins of the rings. (Plate IV. Fig. 5)................................. 2.

Sclerotized rings not connected mesally by a bar formed from the margins of the rings. (Plate IV. Fig. 6)........................................ 4.

2. A structure composed of two distinct sclerites with a membranous area between. (Plate II. Fig. 1)................................................. 3.

A structure composed of a single sclerite that fuses solidly with structure 3 mesally and has no membranous median portion. (Plate II. Fig. 6)................................. PLATYTLIELLUS

3. Length of connecting bar between rings greater than length of a ring; rings tapering to a point laterad. (Plate IV. Fig. 3)................................. BOLTERIA

Length of connecting bar between rings less than length of a ring; rings broadly truncate laterad. (Plate IV. Fig. 2)................................. DICHROOSCYTUS

4. Distance between sclerotized rings greater than length of a ring.............................. 5.

Distance between sclerotized rings less than length of a ring................................. 10.
5. Structure F well developed and coalescing along median line to form a continuous structure. (Plate IV. Fig. 16)................................. 6.

Structure F undifferentiated from surrounding membrane, or if well developed not in contact and fused at midline........................................ 7.

6. G structures well developed. (Plate III. Fig. 11).......................... CALOCORIS

G structures undifferentiated from adjacent membrane............................... MUCHILOCORIS

7. Ring with marginal selerotization differentiated into at least two thicknesses. (Plate IV. Fig. 7)................................. 8.

Ring with marginal selerotization composed of a single thickness. (Plate IV. Fig. 12)................................. 9.

8. Rings with interior area almost closed by margins and interior length more than one-half distance between rings. (Plate IV. Fig. 9)............... THYRILLUS

Rings with interior, not almost closed by the marginal selerotization; interior length less than one-half distance between rings.......... IRBISIA

9. Lateral margins of rings truncate, not rounded; structure C of posterior wall prominently developed; structure B with a prominent posterior disc present. (Plate III. Fig. 18).......................... Sub-genus APOLYGUS

Lateral margins of rings rounded; the margin thickened; structure C inconspicuous; no prominent disc present on structure B. (Plate II. Fig. 15).......................... STITTOCAPSUS

10. H structures possessing sac-like, ventrally directed evaginations on anterior surface. (Plate I. Fig. 7).............................. NEOBORUS

XENOBORUS

TROPIDOSTEPTES

No sac-like protrusions on H structures, if the latter are present.......................... 11.
11. Structure B reduced to a small knob that does not approach the dorsal margin of structure A, or completely absent. (Plate I. Fig. 17). .......... POLYMERUS

Structure B variously developed, but always reaching the dorsal margin of A, usually extended a considerable distance dorsad of A. .......... 13.

15. Structure B absent, rings open at meson forming a single large opening. (Plate V. Fig. 4). .................................. POLYMERUS

Structure B present as a small knob, the rings not meeting openly on the meson to form a single structure. (Plate I. Fig. 17). .......... PARACALOCRIS

LAMPETHUSA
POEAS

14. Structure B lacking a flattened disc on posterior face. (Plate II. Fig. 25). .............. 15.

Structure B possessing a flattened disc on posterior face, usually near ventral part of B and tilted posteriorly from base to apex. (Plate II. Fig. 26). ................................. 19.

15. Structure B branching near dorsal margin of structure A to form a large U shaped apex to B. (Plate II. Fig. 4). ................................. STENOTUS

Structure B of various shapes, but not forming a pair of large divergent arms. ................................. 16.

16. Lateral extremities of rings terminating in a sharp point. (Plate III. Fig. 10). ............ 17.

Lateral extremities of rings rounded, not terminating in a sharp point. (Plate IV. Fig. 6). ........ 18.
17. H structures very prominent, structure B widening at dorsal apex to form a broad spreading flange. (Plate III, Fig. 2) ................................... PANTILIUS

H structures lacking, or evident only as delicate membranes, structure B simple, lacking a spreading dorsal flange. (Plate II, Fig. 25) ............... ADELPHOCORIS

18. Posterior wall possessing a prominent central selerite that is separated by a thin membrane from the true A structures. (Plate II, Fig. 2) .................................... CAPSUS

Posterior wall conventional, the A structures directly in contact with structure B. (Plate II, Fig. 10) ........................................ OPIS THEURIA

19. Disc of structure B extending dorsad of the dorsal margin of structure A. (Plate II, Fig. 14) .... 20.

Disc of structure B not extending dorsad of the dorsal margin of structure A. (Plate II, Fig. 27) ........................................ 27.

20. Disc of structure B reaching or surpassing the ventral margin of structure A. (Plate II, Fig. 14) ........................................ 21.

Disc of structure B not reaching ventrad to the ventral margin of structure A. (Plate II, Fig. 22) ........................................ 24.

21. Rings represented by a closed rod of selerotin, at most with a small sub-oval opening near lateral margin. (Plate IV, Fig. 11) ......................... 22.

Rings normal, with typically narrow marginal selerotization and wide interior. ......................... 25.

22. Structure B not extending laterad of lateral margins of structure A. (Plate II, Fig. 25) .......... GARGANUS

Structure B extending considerably laterad of A. (Plate II, Fig. 26) .................................... PHYTOCORA

25. Structure B very large, extending laterad of structure A for most of the lateral margin of A; structure C broad and rounding at apex. (Plate II, Fig. 30) ......................... LYGIDEA
Structure E small, extending laterad of A for only a short distance near the dorsal margin; structure C tapering to a narrowly rounded dorsal apex. (Plate II. Fig. 16)......... Sub-genus APOLYGUS

24. H structures represented by large twisting flanges, the area of the H structures greater than area of structure A, which is reduced to a narrow band. (Plate II. Fig. 22)........... CALOCORISCA

H structures never with as great an area as structure A, and not twisted......................... 25.

25. Structure F coalescing at the mesal margin to form a simple united sclerite. (Plate IV. Fig. 15)................................. POECILOCAPSUS

Structure F not coalescing at median line, well separated mesad................................. 26.

26. F structures extending anteriorly from the antero-mesal angle of the rings; rings separated mesad by more than one-half the length of a ring. (Plate III. Fig. 8)............ PLATLYGUS

F structures not extending anteriorly from antero-mesal angle of ring, lying in contact with anterior margin of ring for entire length; rings separated mesad by less than one-half the length of a ring. (Plate V. Fig. 5)......................... Sub-genus AGNOCORIS

27. Structure B extending dorsad of structure A in the form of a two-pronged forceps-like structure. (Plate II. Fig. 28)......................... HOCCLAS

Structure B lacking a two-pronged, forceps-like dorsal extension................................. 28.

28. H structures possessing recurved tips, the A structures separated, with membranes between them. (Plate II. Fig. 19)......................... Sub-genus LYGUS

H structures reduced or absent, never twisted at the tip, A structures contacting B for entire breadth, no mesal membranes between the A structures. (Plate II. Fig. 27)......................... COCCOBAPHE
The Neoborus-Tropidosteptes-Xenoborus Complex

These three genera form a distinctive, closely related and very interesting group of species. The female genitalia fail to indicate any generic differentiation, yet the group illustrates structural peculiarities not found in any other genera investigated. The sclerotized rings are of a rather general type and show little to distinguish them from a number of other genera. The posterior wall, however, is most distinctive.

The female genital structures of the complex may be characterized as follows: Sclerotized rings, (Plate I, Fig. 10): relatively small, sub-elliptical, tapering from lateral margin to meson; posterior margin slightly concave, rings widely separated mesad, adjacent sclerotization forming a thumb-like projection at latero-anterior margin, strongest sclerotization laterad of rings. Posterior wall, (Plate I, Fig. 7): ventral margin of A structures curving strongly dorsad, very deeply emarginate; dorsal margin of A structures extending dorsad mesally, curving anteriorly and again ventrad at the dorsal margin, and broadening into a wide knob (structure C?) at extreme anterior end. Structure B represented at most only by a slender inconspicuous transverse bar. E structures well developed and usually very conspicuous. H structures well developed, arising from extremities of A structures and extending inward to meson or near it, these H structures each bearing a
tubular evagination that arises near dorsal margin on anterior side and extends ventrad and cephalad in a pouch-like tube that appears usually to be open along the anterior surface and formed of an infolding of the evaginated walls. In *Neoborus palmeri* however, a true "tube" is present, (Plate I. Fig. 6), and in *Neoborus pacificus*, (Plate I. Fig. 8), only a low evagination is present to suggest the long tubular structure of the other species. This evagination is the most striking feature common to the three genera and immediately sets them apart from any other genus of *Capsinae* investigated.

As with *Neurocolpus* and its allies we are dealing here with a very homogeneous group and one which, as before mentioned, is quite distinct from any other genera studied. Probably these groups do not represent genera but rather subgenera at the most. Certainly all available species must be studied before definite taxonomic conclusions can be drawn.

Further evidence to support the viewpoint that a single generic component is involved may be obtained from a glance at the characters used to separate the three genera. *Xenoborus* is separated from the others by the carinate margins of the pronotum, a somewhat ephemeral character at best in this group. *Neoborus* and *Tropidosteptes* are separated by the relative thickness of the antennal segments and the color.

The biological situation is also extremely interesting. The majority of species of all three breed on species of *F. aximus*. 
For example, Knight (1941) lists one species of *Tropidosteptes*, ten of *Neoherus*, and four of *Xenoborus* from Illinois. Of these the host plants are listed for fourteen and of these only one, *Neoherus populi* Engr. is not recorded as a phytophage of *Fraxinus*.

If the three genera eventually come to be regarded as a single genus, *Tropidosteptes* described by Uhler in 1878 will become the generic name.

**Neoherus Distant 1884**

This genus contains thirty described species, confined in distribution to north and central America. The characters of the female genitalia used in this study are those discussed under the complex above.

**Neoherus palmaris** Reuter, 1908

Sclerotized rings: Typical for complex; Maximum length .32 mm., maximum width 1.18 mm. (Plate I. Fig. 10).

Posterior wall: Large for the group and strongly sclerotised, mesal emargination of A structures deep, sides sinuate; evaginations of H structures large, and apparently closed tubes; anterior expansion, (may be synonymous with structure C), of meso-dorsal extension of A structures elliptical; E structures large, narrowing strongly laterad. Maximum length .65 mm., maximum width .76 mm. (Plate I. Fig. 6).

Neoborus glaber Knight, 1925

Selerotized rings: Typical. Maximum length .14 mm., maximum width .66 mm.

Posterior wall: Meso-ventral emargination deep, somewhat V-shaped; meso-dorsal extension of A structures broad, nearly parallel sided; H structures possessing a broad finger-like extension that protrudes conspicuously in a dorso-mesal direction; anterior expansion, (C?), sub-elliptical, ventral margin flattened. Maximum length .30 mm., maximum width .51 mm. (Plate I. Fig. 4).


Neoborus pacificus Van Dusee, 1921

Selerotized rings: Typical.

Posterior wall: Meso-ventral emargination deep and widely V-shaped; E structures widening laterad; H structures very narrow, curving ventro-mesad, tubular evaginations represented only by a short broad protrusion from surface of selerite; anterior mesal expansion narrow, (poorly seen and exact shape somewhat problematical). Maximum length .31 mm., maximum width .43 mm. (Plate I. Fig. 8).


Tropidosteptes Uhler 1878

This genus at present contains only the type species, T. cardinalis Uhl., from North America. Eleven species have been at one time or another placed in the genus; of these seven are now
placed in *Neoborus*, two in *Xenoborus* and one in *Neocapsus*. The
genital characters are as in the discussion of the complex above.

**Tropidostepes cardinalis** Uhler, 1878

Solerotised rings: Rather typical, but with mesal margin of rings somewhat more rounded than in related species studied.

Maximum length .24 mm., maximum width .91 mm. (Plate I. Fig. 9).

Posterior wall: Ventro-mesal emargination deep and broadly rounded, anterior mesal expansion deep, very shallowly emarginate on dorsal and ventral margins, H structures large and broad for group, tubular evaginations elongate, large and deeply grooved along posterior surfaces; E structures slender. Maximum length .35 mm., maximum width .68 mm. (Plate I. Fig. 7).


H. H. Knight.

**Xenoborus** Reuter 1908

This is a small genus of six described species, confined in
distribution to North America. The characters are discussed under
the complex above.

**Xenoborus commissuralis** Reuter, 1908

Solerotised rings: Typical. Maximum length .13 mm., maximum
width .71 mm. (Plate I. Fig. 11).

Posterior wall: Ventro-mesal emargination broad, narrowing
dorsally; E structures broad mesally, tapering laterad; H structures
slender with a narrow finger-like process that protrudes dorso-mesad from the dorso-mesal angle; tubular evagination short, thick, deeply grooved. Maximum length .35 mm., maximum width .59 mm. (Plate I. Fig. 5).


The Neurocolpus-Paracolocoris-Lampethusa-Poesas Complex

These four genera comprise a closely related group that has female genitalia very distinct from any other capsine genera investigated. The species studied all agree in possessing the following characteristics: The posterior wall, (Plate I. Fig. 15), has strongly curving, lunate, A structures. Structure B is very much reduced and does not reach the dorsal margin of the wings. Its place appears to be taken by a mesal extension of the dorsal margin of the wall that projects dorsally and curves anteriorly at the apex and forms a small structure C(?) as does structure B in other Capsinae. The B structures are well developed and extend laterad of the lateral extremity of the A structures, (Plate I. Fig. 17). There is considerable variation in the minute details of these structures yet all maintain a very similar basic pattern and species within a given genus may appear more similar to species in other genera than to related species within their own genus.
The appearance of the sclerotized rings, (Plate I. Fig. 21), is also distinctive and again illustrates the extremely close relationship between species that exists within the complex. The rings are large with an evenly rounded median margin and a truncate lateral margin. The sclerotization around the rings is rather strong and projects anteriorly in an increasing arc from the lateral extremity of the rings to near the meson where it curves posteriorly in a deep emargination. Nothing has been found of generic value in these rings to separate one of these genera from the other, and very little of taxonomic value from species to species.

The question at once confronts one as to the advisability of generic separation for the species within the four genera. It is not the purpose of this dissertation to change in any way existing nomenclature, however, it is pertinent to suggest that here we are dealing with genera that are apparently not so distinct from one another as are other groups recognized as genera within the subfamily. It is the writer's opinion that these groups of species do not represent separate genera as the term is now used within the subfamily. It will of course be necessary to examine specimens of all available species before a final conclusion is reached. Whether one considers these species separate genera, subgenera or does not separate them nomenclatorally is of course of lesser importance than
the morphological fact that they do represent a distinct, closely related type. However, in view of the considerable degree of difference found between other recognized genera within the sub-family it seems that if the female genitalia are to be considered at all basic in the separation of genera that these four "genera" probably should be designated under a single generic name.

Further support is given this viewpoint when one reviews the characters that have been used to separate the genera in the original descriptions and subsequently. The oldest included genus is *Neurocolpus* Reuter 1876, *Parasalocoris* was described by Distant in 1883, *Lampethusa* and *Poesas* by the same author in 1884 and 1893, respectively. *Neurocolpus* has been separated from the others by the apical dilation of the hairs on the first antennal segment, *Parasalocoris* by the excavated black spots on the pronotum. The others by relative antennal lengths and other minor structural and color differences. While these characters may be perfectly valid it seems to this writer that they do not constitute nearly as basic characters as do the female genital parts and consequently it is concluded that a single generic type is represented.

The accompanying plates illustrate examples of all genera and show more clearly than any discussion the close affinity of the four groups.
HetuTQeolgm Reuter 1876

This is a Neurocolpus genus composed at present of eight nominal species. The various species are very closely related to one another. Knight (1934) separates them on the basis of the relative lengths of the first and second antennal segments, the length of the rostrum, and several color differences. Apparently the male genitalia are of no taxonomic value in the group. A number of species have been examined during this study and little has been found in the female genitalia that might not be a condition of individual variation. Neurocolpus tiliae E. is quite distinct, but mexicanus, simplex, arizonae and jessiae are extremely close to nubilus in the conformation of the posterior wall of the bursa as well as that of the sclerotized rings. Slight differences are present that may or may not prove to be of specific value when large series have been examined. It seems a strong possibility that several of these species will prove to be geographic races (subspecies) when a sufficiently detailed study has been made of the group.

Neurocolpus nubilus (Say), 1852

Sclerotized rings: Typical for complex; adjacent uniformly sclerotized wall with a marked invagination at antero-mesal margin, this wall does not appear to extend posteriorly below the rings as in other members of the complex, but to stop posteriorly at its junction with the anterior margins of the rings. Other than the above mentioned character the rings are of very typical shape and form.
Maximum length .53 mm., maximum width 1.17 mm. (Plate I. Fig. 16).

Posterior wall: A structures relatively narrow for complex, strongly curved, dorsal margin with a cut-in area adjacent to each side of base of a dorsal extension; structure B with a widened lance-like dorsal end; E structures well developed; dorsal-mesal extension of A rather distinctive with a median depressed area and rounded margins. Maximum length .52 mm., maximum width .79 mm; length dorsal extension .17 mm. (Plate I. Fig. 15).


*NeurocoIopuS tiliae* Knight, 1934

Posterior wall: Very distinct from *N. mubilus*; the A structures much thicker, more strongly curving, dorsal margin lacking depressions near base of dorsal-mesal extension, this later broad and narrowing regularly from base to apex; structure B small with widened central area; E structures well developed. Maximum length .47 mm., maximum width .79 mm; length dorsal extension .16 mm. (Plate I. Fig. 17).


*Paraesacocoris* Distant 1883

This genus at present contains approximately forty-seven species with a rather large number of named varieties. The species are confined in distribution to the Neartic and Neotropical regions. The
species are diverse in color and habitus, some closely resemble members of the other three genera within this complex. Two
species of the genus have been investigated, they differ from one
another in a number of specific characters as mentioned below.
The writer has been unable to find any characters in the female
genitalia that appear to be of generic value in separating this
from the other three genera involved in the complex.

Parascalocoris scrupeus (Say), 1852

Selerotized rings: Large, typical for complex with rounded
median margin and truncate lateral margins; adjacent selerotized
dorsal wall uniformly and heavily selerotized, concave dorsad,
with a deep antero-mesal invagination. Maximum length .72 mm.,
maximum width 1.18 mm. (Plate I. Fig. 20).

Posterior wall: A structures wide, strongly curving, dorsal
extension widening from base, then narrowing to apex, but of con-
siderable width throughout; structure B slender, margins undulating.
Maximum length .52 mm., maximum width .72 mm., length dorsal
extension .20 mm. (Plate I. Fig. 13).


Parascalocoris johnstoni Knight, 1930

Selerotized rings: Very similar to P. scrupeus. Maximum
length .88 mm., maximum width 1.34 mm.

Posterior wall: A structures narrower than in scrupeus, less
strongly curved, dorsal extension more slender, narrowing evenly
from base to apex; structure B very small, lacking the undulate margins of sorupus. Maximum length .39 mm., maximum width .79 mm., length dorsal extension .17 mm. (Plate I, Fig. 18).


Pocas Distant 1893

This is a monotypic genus erected for the South American species P. reuteri Dist. This species definitely falls into the same group of species as Neurocolpus, Paracaloosris and Lampethusa.

Pocas reuteri Distant, 1893

Solerotized rings: Very typical of complex, antero-mesal invagination very deep and narrow. Maximum length .58 mm., maximum width 1.44 mm. (Plate I, Fig. 21).

Posterior wall: Essentially of type found within complex, but offering some interesting differences. A structures strongly curving dorsad, ventral margin of A structures broadly emarginate mesally, dorsal extension flaring into a widely lobed apex; structure B composed of a strongly sclerotized elliptical central area bordered by a pair of less strongly sclerotized flanges on each side; B structures very well developed. Maximum length .52 mm., maximum width .72 mm., length dorsal extension .28 mm. (Plate I, Fig. 14).


J. C. M. Carvalho.
Lampethusa Distant 1884

This genus is composed of four species, one found in the Southwestern United States and three Neotropical in distribution. One species, *L. collaris* Reut., has been examined and found to be closely related to the three genera discussed above.

*Lampethusa collaris* Reuter, 1909

Solerotized rings: Typical, median margin rounded and somewhat narrowed as in *Neurocolpus nubilus* (Say), but with solerotization of dorsal wall uniform below rings, median emargination very slight and broad. Maximum length .69 mm., maximum width 1.22 mm. (Plate I. Fig. 19).

Posterior wall: A structures thick and strongly, lamately, curving, the dorsal extension nearly straight-sided for apical one-half of length and broad throughout; structure B composed of a lightly solerotized ventral base that widens abruptly to a broad rounded hoe-like apical region; E structures present, (these latter somewhat mutilated and not shown in Plate I. Fig. 12. Maximum length .37 mm., maximum width .72 mm., length dorsal extension .18 mm. (Plate I. Fig. 12).

Stittocapsus Knight 1942

This is a recently described monotypic genus found in the Southwestern part of the United States. The female genitalia appear to be generically distinct from any other genus investigated. Knight (1942) in the original description placed the genus near Adelphocoris. The structures considered here show no closer relationship to Adelphocoris than to a number of other genera. The sclerotized rings have rather more in common with the species of Caloocoris studied.

Stittocapsus franseriae Knight, 1942

Sclerotized rings: Small for size of species, relatively weakly sclerotized; rings very widely separated mesad, sub-elliptical, with ring broadened irregularly at lateral margin; structure C well developed, curving below rings, extending strongly mesad in a curving arc to near median line. Maximum length .26 mm., maximum width .76 mm. (Plate V. Fig. 2).

Posterior wall: A structures moderately curving dorsad, a broad, very shallow median emargination on ventral margin; structure B prominent, not reaching the dorsal margin of a broad, short, median dorsal extension, B highest at center sloping gradually in all directions; apex of meso-dorsal extension slightly concave, curving anteriorly and widening into a typical structure C; dorsal margins of A structures irregular; B structures not evident.
Maximum length .22 mm., maximum width 1.11 mm. (Plate II, Fig. 15).

Hypotype: Mohawk, Ariz. April 1, 1941. L. L. Stitt.

Capsus Fabr. 1808

This genus is now considered to contain approximately fifteen species. The species are found in the Oriental, Paleartic, Nearctic and perhaps Neotropical regions.

One species, Capsus ater (L.) has been studied. The posterior wall of this species is quite distinctive. The A structures are separated from a large mesal plate by thin membrane, instead of being fused to structure B, (Plate II, Fig. 2). This feature is found only in Dichrooscytus and Bolteria, (Plate II, Figs. 1 and 3), in addition to the present genus. However, these genera lack the broad mesal plate. The sclerotized rings are of a much different type in Capsus than they are in Dichrooscytus and Bolteria.

Capsus ater (L.), 1758

Sclerotized rings: Prominent, semi-elliptical, posterior margin concave, ring thickest at lateral extremity; structure F prominent along anterior margin of each ring, widening near meson, its mesal margin bluntly and irregularly rounded, not in contact with opposite side. Maximum length .54 mm., maximum width 1.21 mm. (Plate IV, Fig. 6).

Posterior wall: Very distinctive, a large median plate present possessing a pair of prominent, posteriorly curving projections
on its ventro-lateral margin; A structures sloping strongly dorsad, connected to median plate only by a very delicate membrane; structure B arising from near dorsal margin of median plate, widening dorsad; structure C represented by a pair of wing-like processes and a delicate elliptical membranous margin; E structures very prominent, projecting considerably laterad of A structures, surface covered with short projecting spines. Maximum length 4.48 mm., maximum width 0.78 mm. (Plate II. Fig. 2).


**Dichrooscytus** Fieber 1858

This small genus is at present composed of fourteen species. The various species are found in the Palearctic and Nearctic regions. Only one species, the genero-type, *D. rufipennis* (Fall.), has been examined.

The affinities of this genus are clearly with Bolteria, to which it is very closely related in the structure of the female genital parts investigated. In both genera the margins of the sclerotized rings, (Plate IV. Fig. 2), coalesce mesally and form a connecting bar, or ridge between the two rings. The B structure area of the posterior wall of the bursa is similar, composed of a long slender rod that widens dorsally and curves anteriorly to form a broad structure C. The A structures of both genera appear to be composed of two parts with a membranous mesal portion between them.
**Dichoecoscytus rufipennis (Fall.), 1807**

Sclerotized rings: (See generic discussion above.) Rings tapering mesad from a broad sub-truncate lateral margin; adjacent sclerotization undifferentiated and weakly sclerotized. Maximum length .22 mm., maximum width .86 mm. (Plate IV. Fig. 2).

Posterior wall: A structures with a mesal membranous area between the two sides, ventral margin straight with slightly produced corners, A structures sub-rectangular rather than lunate curving, widening dorsad; structure B composed of a tapering sclerite that broadens dorsad and curves anteriorly at apex to form a broad elliptical structure C; a pair of poorly differentiated H structures present at extremities of A; E structures prominent, broad and sub-rectangular. Maximum length .47 mm., maximum width .62 mm. (Plate II. Fig. 3).

Hypotype: Neida, Oberlausitz, Germany. June 27, 1943.

Coll. K. H. C. Jordan.

**Bolteria** Uhler 1887

This is a small genus composed of seven species, the members of which are confined in distribution to the Nearctic region. One species, *B. luteifrons* Kngt., has been examined. The genus is very close to *Dichoecoscytus* Fieber and has certain features in common with *Platytyllellus* (see discussion under the above mentioned genera).
A study of all the species of Bolteria and Dishroascoy tus to
determine the generic limits would be of considerable interest.

**Bolteria luteifrons** Knight, 1922

Selerotized rings: Elliptical, widely separated mesad,
connected mesally by a long slender selerotized band formed by
coalescence of margins of selerotized rings; adjacent selerotiza-
tion undifferentiated. Maximum length .16 mm., maximum width
.41 mm. (Plate IV. Fig. 3).

Posterior wall: A structures separated into two selerites
by a membranous mesal area, the selerites curving strongly dorsad
and narrowing from meson to lateral tips, dorsal margin more
strongly selerotized than ventral; structure B elongate, widening
dorsally to a broad knob, an abrupt expansion of rod about two-
thirds distance from its ventral point; structure C concave on
dorsal side, with a distinct anteriorly directed ridge arising
from dorsal margin, anterior surface strongly concave, form
reniform. Maximum length .29 mm., maximum width .68 mm., length
structure C .09 mm., width structure C .20 mm. (Plate II. Fig. 1).

**Phytocoris** Fallen 1814

This is probably the largest single genus of the Miridae.
Approximately two hundred and sixty-six species are considered to
be present within the generic limits. The distribution is
predominately Nearctic and Palearctic. Such a tremendous assemblage of species from every major faunal area of the world would require a study more extensive than the present one for itself alone. The female genitalia of only a single species have been examined, and, if this species is at all indicative, the genitalia seem to indicate a distinct group with relationship to the fourth group of genera, (see subfamily discussion).

Phytocoecis osborni Knight, 1923

Sclerotized rings: Very distinctive, rings reduced to a small round opening near lateral margin, marginal sclerotisation thick, extending mesad in a distinct bar to near median line, not in contact mesad. Maximum length .14 mm., maximum width .72 mm.

(Plate IV, Fig. 11).

Posterior wall: A structures slightly concave near meson on ventral margin, curving conventionally dorsad; structure B consisting of a flat disc with a more heavily sclerotised central line apparent, this disc tilted strongly posteriorly from its ventral base to dorsal apex, the dorsal extension of B running almost at right angles in this species, actually extending more anteriorly than dorsally; B structures prominent, nearly the size of the A structures. Maximum length .27 mm., maximum width .72 mm.

(Plate II, Fig. 26).

Lytgus Hahn 1833

This is an enormous genus containing upwards of three hundred species, various ones of which are found in all the major faunal regions of the world. Many of the species are quite variable and a large number of varieties and synonyms have been described in the literature. Apparently many of the species will prove to be polytypic and a large scale study using detailed population analyses is badly needed and offers an excellent field of study.

The present study is much too limited in scope to present a completely clear picture of the group. However, the few species examined do show some most interesting situations.

The genus Lygus has been considered to be composed of the following subgenera: Lygus Hahn 1833, Orthops Fieber 1868, Lygocoris Reuter 1875, Agnocoris Reuter 1875, Paralygus Reuter 1906 and Neolygus Knight 1917.

However, China (1941) points out that the first valid type fixation for Lygus Hahn 1833 is that of Distant (1904), who names L. pabulinus as type. The subgeneric name Lygocoris Reuter 1875 therefore becomes a synonym of Lygus. China proposes the subgenus Apolygus for those species formerly included under the subgenus Lygus.

Material has been studied from five of these subgenera and the characters of the female genitalia indicate that the subgenera,
at least in some cases, will ultimately prove not to be con-
generic. Knight (1941) has already accorded generic rank to his
Neolygus, a conclusion that the female genitalia corroborate to a
marked degree. Indeed, the species of Neolygus studied do not
appear to be even closely related to the Apolygus complex and their
former position within the same genus appears to have been based
upon a superficial resemblance rather than any true phylogenetic
relationship. (see Neolygus for discussion.) The subgenus Lygus
containing the single included species L. pabulinus (L.) also has
female genitalia very dissimilar from Apolygus and probably should
be considered a distinct genus. The posterior wall of the bursa
in this species is very unique among the species studied, (Plate II.
Fig. 18). Unfortunately, were this subgenus to be raised to
generic rank, all of the economically important "Lygus" bugs of
North America would take a different generic name.

The subgenus Agnostorius Reuter also appears to be rather dis­
tinct from the other Lygus species studied.

Within the subgenus Apolygus the following species have been
studied: oblineatus, elius, hesperus, vanduseni, plagiatus and
atrilavus. The evidence obtained from a study of these species
indicates that the posterior wall is rather constant throughout the
various species. Certain small differences can be ascertained, but
whether these represent actual specific characters or will indicate
only individual variation can only be established by the study of
large series of all the species from various parts of their respective ranges. For the present, the differences appear to be doubtful as aids to specific identification. The character of the posterior wall therefore constitutes, on present evidence, a generic character. The sclerotized rings show a basic pattern throughout the species studied. Nevertheless, they vary considerably from species to species and appear to offer good characters for specific differentiation. Only in the case of \textit{L. elius} and \textit{L. hesperus} has the writer been unable to satisfactorily separate the species upon this character.

The subgenus \textit{Apolygus}, upon the evidence of the species studied, may be characterized as follows: Sclerotized rings, (Plate III. Fig. 18), sub-rectangular, not noticeably narrowed either mesad or laterad, a prominent structure \textit{F} extending from anterior margin of rings in an antero-mesal direction, but not in contact on median line, lateral margin of this adjacent sclerite protruded at anterior angle into a more or less hooked process which may be of some value in specific determination; structure \textit{G} poorly developed, indistinct, or lacking. Posterior wall, (Plate II. Fig. 14); as mentioned above this structure is very constant within the subgenus and appears to be unquestionably of generic importance. The \textit{A} structures curve normally; \textit{H} structures absent; structure \textit{B} from a posterior view consisting of a flat disc between \textit{A} structures, tipped posteriorly from ventral to dorsal ends, a
median extension proceeds from below this disc, curves strongly cephalad at its dorsal margin and possesses a strongly sclerotized distinctively shaped structure C.

Lygus vandusei Knight, 1917

Sclerotised rings: Very small, widely separated, a distinct angle from posterior to anterior margin along mesal margin; F structures prominent, curving very strongly cephalad from their origin to mesal extremity. Maximum length .55 mm., maximum width 1.08 mm. (Plate III. Fig. 18).

Posterior wall: As in generic discussion. Maximum length .42 mm., maximum width .85 mm. (Plate II. Figs. 8 and 14).


Lygus plagiatus Uhler, 1895

Sclerotised rings: Rings short and wide from anterior to posterior margin, considerably larger than vandusei, median margin rounded; F structures bordering anterior margin of rings for nearly entire length, not strongly produced anteriorly, widely separated mesad, lateral margin produced in a thick blunt hook. Maximum length .43 mm., maximum width 1.12 mm. (Plate III. Fig. 13).

Posterior wall: As in generic discussion. Maximum length .40 mm., maximum width .72 mm.

Lygus atriflavus Knight, 1917

Sclerotised rings: Small, very widely separated mesad, rings narrower and more elongate than in preceding species; F structures prominent, extending strongly cephalad in a wide arc to terminate near mid-line, prominent hook at lateral margin of F structure. Maximum length 0.46 mm., maximum width 1.01 mm. (Plate III, Fig. 12).

Posterior wall: As in generic discussion. Maximum length .30 mm., Maximum width .75 mm.


Lygus oblineatus (Say), 1832

Sclerotised rings: Relatively elongate and slender, more of a type with elisus, hesperus and atriflavus than with vanduzesti and plagiatus; rings considerably longer than the above; F structures weakly developed, not extending anteriorly away from anterior margin of rings, a prominent lateral hook present.

Maximum length .19 mm., maximum width 1.08 mm. (Plate III, Fig. 19).

Posterior wall: As in generic discussion. Maximum length .29 mm., maximum width .76 mm.


Lygus hesperus Knight, 1917 and Lygus elisus V.D., 1914

Sclerotised rings: The writer has been unable to distinguish between these two forms on the conformation of the rings. In both species the rings resemble oblineatus, but are noticeably less
longate and the F structures curve moderately cephalad from the anterior margin of the rings. The shape of the lateral projection of structure F differs in the two species as shown in Plate III. Figs. 16 and 17, but whether this will prove to be of specific value must await the study of a series of both species. Maximum length .35 mm., maximum width 1.01 mm. (from L. hesperus).

Posterior wall: As in generic discussion. Maximum length .31 mm., maximum width .68 mm. (from L. elisus).

Lygus hesperus - Hypotype: Emery Co. Utah. August 10, 1921
G. O. Wiley.

A. C. Burrill.

The subgenus Agnecoris is perhaps generically distinct from Apolygus, at least the type species L. rubicundus does not appear to be closely allied to the species of Apolygus studied. Both the sclerotized rings and the posterior wall offer characters at variance with the type shown by the Apolygus species. Chief among these may be mentioned the shape of the rings which are ovate or cordiform rather than rectangular, with the mesal end tapering to a sharp point; further, the comparative lack of differentiation of structure F is informative, (Plate V. Fig. 5). In the posterior wall the H structures that arise from the lateral extremities of the A structures and curve mesad and ventrad to near structure B,
are not found in *Apolygus* species, further structure C is of a
different nature than in the preceding forms, (Plate II. Fig. 19).

*Lygus rubicundus* (Fall.), 1829

For structural characteristics see subgeneric discussion above.

Sclerotized rings: Maximum length .12 mm., maximum width .40 mm.

Posterior wall: Maximum length .19 mm., maximum width .53 mm.


The monotypic subgenus *Lygus* appears to be rather distantly
related to the species of *Apolygus* studied. Certainly unless subse-
quently studies show a merging of characters not apparent from the
material observed, this subgenus will be recognized as of distinct
generic rank. In certain respects the relationships appear to be
with *Neolygus* rather than any of the other subgenera.

*L. pabulinus* (L.), 1761

Sclerotized rings: Small for size of species, sub-triangular,
tapering strongly from broad lateral margin to a pointed mesal end,
posterior margin concave, nearly in contact mesad, no apparently
well differentiated adjacent sclerotization present, some resemblance
to *Cococobaphes sanguinarius* in contour of the rings. Maximum length
.12 mm., maximum width .55 mm. (Plate V. Fig. 3).

Posterior wall: Structure complicated; A structures only
moderately curving with concave dorsal margin; a small structure B
in form of a flat disc with a short dorsal extension; structure C
apparently absent; H structures arising from extremities of
A structures, extending as wide straight bar-like sclerites to near meson where the sclerites twist ventrally and anteriorly and terminate in a pair of anterior points; E structures prominent, narrow, their basal connection not approaching lateral margin of A structures; a pair of large spreading folds extending anteriorly from the dorsal margin of the paired sclerites, (not visible in figure), these folds nearly as large and prominent as the A structures. Maximum length .27 mm., maximum width .62 mm. (Plate II. Fig. 18).


Eullenberg (1947a) illustrates the female genitalia of Lygus campestris (L.) From his fine illustration it appears that the subgenus Orthops also may prove to be distinct. In this species, the sclerotized rings are apparently not differentiated from the surrounding membranes.

The writer has been able to examine one teneral specimen of Lygus salaevi Stal, 1862, a species that belongs to the subgenus Paralygus. The sclerotized rings are somewhat similar to those of Lygus rubicundus and appear to have little in common with the type found in the subgenus Apolygus.
Platylygus Van Duzee 1915

This is a small Nearctic genus of six nominal species. Five of the species are western and southwestern in distribution in the United States. The genericotype, *P. luridus* Reut., is found in the northeastern states. One species, *P. grandis* Knight., has been investigated.

**Platylygus grandis** Knight, 1919

Sclerotized rings: Large even for size of species, slenderly elliptical, lying at a markedly divergent angle from anterior to posterior end; F structures extending in an antero-mesal direction from the anterior margin of the rings, not in contact mesad; G structures weakly developed, broadly in contact mesad. Maximum length 0.31 mm., maximum width 1.58 mm. (Plate III, Fig. 8).

Posterior wall: Suggestive of *Poecilocapsus lineatus* (Fabr.); meso-ventral margin of A structures broadly and shallowly emarginate; structure E curving caudal and recurved strongly anteriorly at dorsal margin; a delicate membranous structure C present; H structures curving from dorso-lateral extremities of "rod-like" extension of A structures, as in *Pantillus*, *Calocoris* and *Poecilocapsus*; E structures prominent with a conspicuous ventral projection of ventro-lateral angle. Maximum length 0.42 mm., maximum width 1.22 mm. (Plate II, Fig. 24).

Hypotype: Trinidad, Colo. (Stonewall 8500 ft.) August 7, 1926. H. H. Knight.
Calocoris Distant 1884

This is a small genus of nine described species, the members of which are found in Central America, Mexico and the southwestern part of the United States. One species of the genus has been studied. The appearance of the posterior wall of the bursa is most interesting and distinctive, (Plate II, Fig. 22).

Relationship with Calocoris, Pantilius, Psecoilocapsus and Platyclepsus is suggested, both in the appearance of structure B and especially in the tremendous development of the H structures that arise from the extremities of the A structures. The narrow bar-like condition of structure A has not been discovered in any other genera studied.

Calocoris sticticollis (Stal), 1860

Sclerotized rings: Rather small for size of species, tapering strongly from wide lateral end to a blunt point at mesal end; adjacent sclerotization nearly uniform over entire surface, no prominent F structures evident. Maximum length .20 mm., maximum width .84 mm.

Posterior wall: Very distinctive; A structures very narrow and bar-like, curving strongly dorsad; H structures developed into large strongly twisted expansions that are recurved ventrally and terminate in a wide curving expanded plate; structure B suggestive of Calocoris, but with a disc-like ventral plate, not approaching ventral margin of A structures and tilted posteriorly from base to
apex, dorsal extension recurving anteriorly, terminating in a membranous extension that broadens to apex; E structures prominent. Maximum length .40 mm., maximum width .79 mm. (Plate II. Fig. 22).


**Poeoilocapsus** Reuter 1878

This is a small genus containing ten nominal species; all but one, the generotype, *P. lineatus* (Fix.), confined in distribution to Mexico and Central America.

The female genital affinities seem to point toward *Calocoris* and *Pantilinus*, insofar as these three genera possess large H structures attached near the lateral extremities of the A structures of the posterior wall of the bursa copulatrix.

**Poeoilocapsus lineatus** (Fabricius), 1798

Sclerotized rings: Sub-elliptical, strongly sclerotized, widely separated mesad, postero-lateral angle very strongly sclerotized and thinned; F structures prominent along entire anterior margin of rings, curving mesad, broadly in contact mesally. Maximum length .45 mm., maximum width 1.22 mm. (Plate IV. Fig. 15).

Posterior wall: A structures moderately curving, latero-dorsal extension very strongly sclerotized, forming a bar-like
structure that extends mesad along dorsal margin of A structures, ventral margin of A structures undulate mesally; structure B prominent, not approaching ventral margin of A, consisting of an elliptical plate tilted dorso-caudal, with dorsal extension that curves anteriorly and widens into a broad membranous structure C; extremities of A structures with paired, anteriorly twisting H structures somewhat as in Calocoris and Pantilius, these selerites produced mesad half way to mid-line; E structures prominent. Maximum length .32 mm., maximum width .89 mm. (Plate II. Fig. 29). Hypotype: Great Swamp, Chatham Twp., N. J. July 9, 1944. J. & W. Rapp.

Lygidea Reuter 1879

This is a small genus composed of twelve species, all but the type species being found in the Nearctic region. The generotype, illota Stal, was described from Siberia. One species in the genus, L. rosacea Reuter, has been examined. This species is a very typical member of the fourth group of genera within the subfamily, (see subfamily discussion).

Lygidea rosacea Reuter, 1909

Selerotized rings: Large and strongly selerotised, sub-elliptical, tapering mesad, posterior margin slightly concave, moderately separated mesad; adjacent selerotization well developed, F structures arising just laterad of center of anterior margin of
rings, broadening mesad to terminate at mesal tip of rings in a broad truncate margin; C structures broadly curving below the rings, lateral margin with a blunt lateral projection. Maximum length .49 mm., maximum width 1.08 mm. (Plate V, Fig. 1).

Posterior wall: A structures curving moderately dorsad; structure B in form of flattened disc tilted posteriorly from ventral to dorsal extremities, dorsal extension broadening and flaring dorsad with lateral margin sloping anteriorly from meson; H structures prominent, curving ventrad from lateral origin toward meson, tapering to a blunt point mesad, dorsal margin with a projection near center that curves anteriorly and forms a curving bend anterior to the selerite proper; E structures very large, produced laterad of A structures for nearly entire length. Maximum length .30 mm., maximum width .75 mm. (Plate II, Fig. 30).


Garganus Stal 1862

This is a small genus composed of six species. The members of the genus are confined in distribution to the Western Hemisphere. One species, Garganus fusiformis (Say), has been studied. The posterior wall is of a rather generalized nature, (Plate II, Fig. 25), but the selerotized rings are very distinctive in that the rings are reduced to a single elongate bar, (Plate IV, Fig. 10). This bar-like condition of the rings is probably generically
distinutive. Despite the peculiar nature of the rings, the posterior wall indicates that the genus belongs with the fourth group of species in the subfamily, (see subfamily discussion).

*Garamus fusiformis* (Say), 1832

Selerotised rings: Rings absent, represented only by an undulate bar that extends in a cephalo-caudal direction from meson to lateral extremity. This bar may represent either a coalescence of the rings or either the anterior or posterior margin of the ring, the other margin being absent; adjacent selerotisation present laterad and extending anterior to the "ring"; no indication of structure selerotisation. Maximum length .21 mm., maximum width .58 mm. (Plate IV, Fig. 10).

Posterior wall: A structures curving normally dorsad, ventral margin straight for considerable distance from meson; structure B area with a flat indistinct disc and a heavily selerotised median bar that widens dorsad; weak H structures present, arising from lateral extremities of A structures; E structures large, but not projecting laterad of A structures. Maximum length .14 mm., maximum width .40 mm. (Plate II. Fig. 23).


*Hesrias* Distant 1884

The genus *Hesrias* is composed of twenty-seven nominal species confined in distribution to the Western Hemisphere. Three species
of the genus have been examined, *dislocatus, fallax* and *signoreti*. The female genital parts reveal that *signoreti* is probably not con-
generic with the other two species examined. A study is needed of
the genitalia of all the species to determine the generic limits
of this group.

*Horoias dislocatus* (Say), 1852

Sclerotized rings: Rings lunate, very elongate and slender,
in close approximation along median line, not narrowing perceptibly
mesad or laterad; F structures weakly developed, lying close along
anterior margin of rings; G structures prominent, tapering from
a broad lateral margin to a blunt point one-third distance from
mesad extension of rings, a prominent thumb-like lateral protrusion
present. Maximum length .58 mm., maximum width 1.26 mm. (Plate IV.
Fig. 8).

Posterior wall: Structure distinctive; A structures curving
normally dorsad; H structures curving broadly mesad to terminate
one-fourth way from median line; structure B composed of a flat
disc tilted posteriorly from ventral to dorsal margins, a dorsal
extension proceeding from this and anterior to it that is bifur-
cate and forms a forceps-like structure; membranous extensions
from tips of paired H structures curve ventrad and divide near
this forceps formation into a pair of lateral prongs; E structures
prominent. Maximum length .39 mm., maximum width .91 mm.
(Plate II. Fig. 28).

Hypotype: Locality unknown. X429 J. A. Slater collection.
**Horcas fallax** Reuter, 1909

Sclerotized rings: Rings considerably less elongate than in *dislocatus*, more sub-elliptical than lunate, area within rings conspicuously broader in comparison with length; condition of adjacent sclerotization indefinite in specimen examined, but a prominent thumb-like lateral protrusion present. Maximum length .32 mm., maximum width .89 mm.

Posterior wall: General facies similar to *dislocatus*; structure B flattened, disc area absent, but perhaps lost in dissection, forceps-like dorso-mesal extension with prongs continued dorsad to form a closed circular area with a strong membrane within, this perhaps homologous to structure C of other genera; H structures broader and proportionately less heavily sclerotized than in *dislocatus*. Maximum length .30 mm., maximum width .72 mm.


**Horcas signoreti** (Stal), 1859

This species is certainly not congeneric with the above if the female genitalia serve at all as indicators of relationships. The sclerotized rings, (Plate IV. Fig. 14), are of quite a different type having the anterior-mesal angles of the rings produced very strongly cephalad as prominent horn-like extensions. Of more significance perhaps is the fact that the posterior wall is of an entirely different type. The forceps-like dorsal extension of
structure B is lacking and B is of a more conventional nature.
The H structures are absent and the A structures are much less
prominently produced and tapering laterad, and the area of the A
structures is much greater proportionate to its size, (Plate III.
Fig. 4).


**Cocobaphes** Uhler 1878

This is a monotypic genus, the lone species, *C. sanguinarius*
Uhl., is confined in distribution to the eastern United States.

**Cocobaphes sanguinarius** Uhler, 1878

Sclerotized rings: Rings elongate, widening laterad, strongly
sclerotized with posterior and lateral margins thickest; F struc-
tures curving mesad; a definite thumb-like projection laterad on
G structures; rings moderately wide apart mesad. Maximum length
$.32\text{ mm.}$, maximum width $1.04\text{ mm.}$ (Plate IV. Fig. 12).

Posterior wall: A structures moderately curving; structure B
strongly developed, a sub-circular strongly sclerotized area midway
from ventral margin; median extension bearing pair of very prominent
lateral elongations that form a conspicuous dorsal margin to the
entire structure, these lateral elongations slope antero-ventrad
from the dorsal margin and form the most conspicuously distinct
portion of the wall; E structures prominent. Maximum length $.25\text{ mm.}$,
maximum width .94 mm. (Plate II. Fig. 27).

H. H. Knight.

**Adelphocoris Reuter 1866**

This is a genus of large mirids containing approximately forty-three described species and a number of varieties. The species are most numerous in the eastern part of the Palaearctic region, but members are found in all the major faunal areas of the world with the exception of the Neotropical. In the three species studied the posterior wall is nearly identical in all three species, but the sclerotized rings indicate certain small specific differences.

**Adelphocoris rapidus (Say), 1832**

Sclerotized rings: Very large and broad, rings nearly meeting on meson, mesal margin broad and running along median line for a considerable distance, tapering strongly to a point laterad; F structures appear absent; G structures weakly developed and indistinct. Maximum length .54 mm., maximum width 1.09 mm. (Plate V. Fig. 6).

Posterior wall: See *A. lineolatus* (Goetz). Maximum length .19 mm., maximum width .94 mm.

Adelphocoris superbus (Uhler), 1875

Sclerotized rings: Very similar in shape and form to A. rapidus. In the specimen examined the rings are somewhat more elongate in this species than in the preceding. In view of the opinion of some authors that these species represent races rather than distinct species, examination of a series will be necessary to determine whether or not the above distinction will prove to be of specific value. Maximum length .62 mm., maximum width 1.22 mm.

Posterior wall: See A. lineolatus (Goese). Maximum length .18 mm., maximum width 1.00 mm.


Adelphocoris lineolatus (Goese), 1778

Sclerotized rings: Less obovate than preceding two species, more narrowed at median line, forming a noticeably less broad median margin along midline; G structures more prominently developed and broadly in contact mesad. Maximum length .54 mm., maximum width 1.08 mm.

Posterior wall: Structure simple; A structures narrow, ventral margin straight for a considerable distance and curving only moderately dorsad; structure B curving posteriorly from ventral to dorsal margins, dorsal margin strongly recurved anteriorly and widened into a simple C structure from whence membranous connectives connect with the lateral extremities of the A structures; E structures prominent. Maximum length .19 mm., maximum width .86 mm. (Plate II. Fig. 25).

Pantilius Curtis 1833

This is a small genus composed of four species confined in distribution to the Eastern Hemisphere. Of the four, one species, the genericotype, *Pantilius tunicatus* (Fabr.), has been studied. The female genitalia of this species indicate some relationship to *Calocoris* but show some rather remarkable characteristics.

**Pantilius tunicatus** (Fabr.), 1781

Sclerotized rings: Large and strongly sclerotized, median margin broadly rounded, lateral margin tapering to an elongate point, posterior margin concave; Structure F produced considerably cephalad of rings, with a very wide, deeply sinuate median emargination, which terminates mesad of rings at a strongly sclerotized, elliptical button-like sclerotized area; structure G lies ventrad of the rings, widest at lateral margin, possessing a lateral thumb-like protrusion at antero-lateral angle, whole sclerite tapering mesad and concave dorsally. Maximum length .47 mm., maximum width 1.15 mm. (Plate III. Fig. 10).

Posterior wall: Very distinctive, A structures only slightly curving on ventral margin, elliptical; structure H large, composed of posteriorly curving lateral extensions with lobed distal ends; structure B large, heavily sclerotized, narrowing near middle, widening dorsad, with dorsal margin extended strongly caudad to form a shelf-like ledge; E structures small and inconspicuous. Maximum
length .34 mm., maximum width .98 mm. (Plate III. Fig. 2).

Hypotype: Bautzen, Oberlausitz, Germany. October 14, 1939.

K. H. C. Jordan.

Calocoris Fieber 1858

This is a large genus containing approximately eighty-four described species, several of these with a number of varietal names. The various species are found in all the faunal regions of the world, but the center of distribution lies in the Palearctic Region.

It is difficult in a genus of this size to draw conclusions as to its affinities on the basis of a few species. However, the female genitalia appear to illustrate a distinct generic group with a relationship to Pantilius.

The generic characters of the female parts studied are as follows:

Structure F arises from anterior margin of rings, and curves antero-mesad to median line, where a thin mesal connection is present. Below rings Structure G likewise curves antero-mesad to meet at the median line. This sclerotized piece is very suggestive of Pantilius. The sclerotized rings are widely separated mesad and strongly sclerotized. The posterior margin is produced into a narrow ridge on its internal side, (Plate III. Fig. 11).

The posterior wall is rather suggestive of Pantilius. Structure B reaches the ventral margin, or close to the margin of the A structures and dorsally curves strongly cephalad to widen into a broad
distinct C structure. Most suggestive of Pantilius are the H structures attached near the dorso-lateral tips of A structures. These H structures curve strongly cephalad and are somewhat twisted, (Plate III. Fig. 3).

Calocoris norvegicus (Gmelin), 1788

Sclerotized rings: Typical of the genus; rings moderately sub-elliptical. Maximum length .61 mm., maximum width 1.21 mm. (Plate III. Fig. 11).

Posterior wall: Structure B narrowed one-half way from ventral margin, widening dorsad; structure C broad, basal sclerotization much the thickest, sloping posteriorly both dorsad and ventrad of a transverse median ridge; H structures arising from tips of A structures, broad, curving strongly antero-ventrad, surface sloping in several directions; dorsal margins of A structures sharply emarginate near meson, forming a narrow connection with structure B. Maximum length .35 mm., maximum width .73 mm. (Plate III. Fig. 3).


Calocoris blelavatus (H.S.), 1836

Sclerotized rings: Rings very slender and elongate, sloping caudo-laterad from mesal margin; F structures very slender forming a fine mesal connection; G structures typical with a very distinct lateral thumb-like protrusion on lateral margin. Maximum length .42 mm., maximum width 1.18 mm. (Plate III. Fig. 14).
Posterior wall: Very similar to Calocoris norvegicus; structure B appearing not to reach ventral margin of A structures; A structures themselves much thicker dorso-ventrally than in Calocoris norvegicus. Maximum length .36 mm., maximum width .81 mm.

Hypotype: Lausche, Oberlausitz, Germany. August 11, 1948.

K. H. C. Jordan.

Calocoris fulvomaculatus (De Geer), 1773

Seleritized rings: Rings short, irregularly ovoid, much wider and less elliptical than in two species above; F structures thicker than in Calocoris bislavatus. Maximum length .56 mm., maximum width 1.04 mm. (Plate III. Fig. 15).

Posterior wall: Not available.

Hypotype: Casslau(?), Oberlausitz, Germany. June 23, 1940.

K. H. C. Jordan.

Buchilocoris Reuter 1909

This is a South American genus composed of two species. The affinities of the genus are with Calocoris and its allies (see Calocoris), particularly in the development of the H structures that arise from the extremities of the A structures.

Buchilocoris rufinascus (Stal), 1860

Seleritized rings: Rings short and oval, flattened along posterior margin, mesal end somewhat narrowed; F structures narrow, nearly uniform
in width throughout, broadly in contact mesad, curving posteriorly from connection with rings to meson and dropping ventrad toward median line. Maximum length .30 mm., maximum width 1.08 mm. (Plate IV. Fig. 16).

Posterior wall: Ventral margin of A structures with a short median emargination, A structures rather thick dorso-ventrally; H structures present at dorso-lateral extremities of A structures, the former with a very narrow connection, widening to a broad, truncate distal end, the sclerotization weak; structure B reaching ventral margin of A structures by virtue of a relatively weakly sclerotized ventral piece that widens ventrad and appears somewhat lobed; B structure proper, curving posteriorly with dorsal extension typically recurved at apex, bearing an elongate-elliptical membranous structure C; E structures prominent. Maximum length .40 mm., maximum width .84 mm. (Plate II. Fig. 5).


Iribisia-Thyrillus Complex

These two genera are certainly very closely related in regard to the female genital structures used in this study. The two genera have been recognized as very close in relationship by all workers on the Miridae. However, whether Thyrillus pacificus Uhler should be considered congeneric with the various species of Iribisia remains an open question. The female genital structures considered here indicate very
close relationship, but *Thyrillus pacificus* shows some characteristics that tend to place it somewhat apart from *Irbisia shulli* Rngt. and *Irbisia sericans* Stal, the two species of *Irbisia* studied.

The complex may be recognized by the following characteristics:

The sclerotized rings are strongly sclerotized, small in size and widely separated from one another mesally. A rather marked degree of differentiation is present in the marginal sclerotization of the rings, (Plate IV, Fig. 7). The posterior wall has A structures that are concave on the ventral margin, structure B is strongly developed and possesses a prominent posterior protrusion, (Plate II, Fig. 17), that appears to be of specific importance. Structure B dorsad of the posterior protrusion expands noticeably and has an anteriorly recurved dorsal margin.

*Thyrillus pacificus* Uhler, 1894

Sclerotized rings: Margins of rings very thick and closely appressed, leaving little or no central area present, appearing more like an irregular sclerotized bar than a ringed structure, rings widely separated mesally, dorsal wall sclerotization weak, not extending anteriorly any appreciable distance from the rings. Maximum width 1.15 mm. (Plate IV, Fig. 9).

Posterior wall: A structures strongly curving, deeply concave on ventral margin; structure B with a characteristic posterior protrusion, dorsad of protrusion median process is of uniform width for some distance then widens dorsally. Maximum length .25 mm.
maximum width .94 mm. (Plate II. Figs. 20 and 21).


Irbisia sericans (Stal), 1858

Solerotized rings: Heavily solerotized, appearing somewhat intermediate between T. pacificus and I. shulli, area within rings narrow, postero-lateral region of rings with an apparently additional solerotized partial ring, dorsal wall extending anteriorly a considerable distance beyond rings, possessing a strongly concave mesal margin. Maximum width 1.15 mm. (Plate IV. Fig. 7).

Posterior wall: A structures narrower and less strongly curved than in I. shulli and T. pacificus, ventral margin broadly and shallowly emarginate, posterior protrusion of structure B characteristic, median process expanding broadly dorsad. Maximum length .20 mm., maximum width .79 mm. (Plate II. Figs. 16 and 17).


Irbisia shulli Knight, 1941

Solerotized rings: Rings less heavily solerotized than in preceding species, presenting a more elliptical, typical ring-like appearance with a much wider central area; an apparently accessory thickening present in postero-lateral region of ring margin; dorsal wall produced anteriorly, but less prominently than in I. sericans, weakly concave mesally. Maximum width 1.05 mm. (Plate IV. Fig. 5).

Posterior wall: Ventral margin of A structures very shallowly emarginate mesad; structure B widening apically, but less markedly
than in sericans, posterior protrusion appears characteristic. Maximum length .19 mm., maximum width .82 mm. (Plate II. Figs. 11, 12 and 13).


**Platytyellus** Reuter 1906

This is a large genus containing approximately seventy-nine described species, the members of which are confined in distribution to the Western Hemisphere. The largest number of species are known from the Neotropical region.

The outstanding generic feature of the species studied is the median bar formed by the solerotised rings. This bar extends between the two rings and fuses them together into a single united structure, (Plate IV. Fig. 1). The rings themselves are strongly solerotized. In insitivus, crucifer and costalis the rings are large, widest at the lateral ends and tapering to the meson. In cirroummaculatus and flavicostus the rings are relatively smaller, not so tapering from meson to lateral extremity and with less of a "tear drop" effect than in the preceding three species.

The posterior wall, (Plate II. Fig. 6), is well developed, heavily solerotized and of a complicated nature. The A structures are of a fairly conventional type. A strongly developed structure B is present that widens dorsad and curves antero-ventrad and then anteriorly again. Structure C is large, variously shaped and offers
good specific differences between the various species. As mentioned
in the subfamily discussion, nothing has been found in this genus to
warrant tribal distinction from the Capsini, indeed the female struc-
tures investigated place *Platytylellus* rather closer to some capsines
than many of them appear to be to one another.

*Platytylellus* insitivus (Say), 1832

Solerotized rings: Large and heavily solerotized, much widened
erad, the rings curving posteriorly from meson to lateral ex-
tremity. Maximum length .30 mm., maximum width 1.29 mm.

Posterior wall: Structure B well differentiated; structure C
very large, rectangular, posterior face concave, ventro-lateral margin
produced into short sharp processes, dorsal margin irregularly rounded;
A structures narrow and slender. Maximum length .40 mm., maximum
width .99 mm.; maximum length structure C .25 mm., maximum width
structure C .21 mm.


*Platytylellus* costalis (Stal), 1858

Solerotized rings: Form and shape very similar to *insitivus*,
but considerably larger. Maximum length .55 mm., maximum width 1.73
mm. (Plate IV. Fig. 1).

Posterior wall: A structures proportionately broader than in
the preceding species, more lunately curved; structure B widened
dorsad; structure C very broad with a wide dorsal margin, anterior
surface deeply concave mesad, ventro-lateral angles produced into
Platytylellus aconti (Stal), 1854

Solerotized rings: Less elongate than in the preceding species, laterally not curving so strongly caudal, lacking "tear drop" effect, lateral portion of ring not considerably wider than mesal portion.

This species appears in regard to this structure to represent a distinct group within the genus and yet to retain the basic generic character of the connecting bridge (or bar) between the two rings. Maximum length .14 mm., maximum width .36 mm. (Plate IV. Fig. 4).

Posterior wall: A structures of rather normal shape, structure B widest near center of A structures narrowing dorsally and ventrally; structure C lying at an angle to A structures, irregular at its wide dorsal margin, narrowing evenly ventrally to a bluntly rounded ventral end, acute ventro-lateral processes of two preceding species lacking. Maximum length .23 mm., maximum width .65 mm.

Hypotype: M. Gerais, Brazil. C. R. Claro 1941. J. C. M. Carvalho.

Platytylellus flavicostus Berg, 1884

The only available specimen of this species is somewhat teneral. The affinities appear to lie with insitus and costalis in that the solerotized rings are widened laterally and structure C
possesses very sharp prominent processes on the ventro-lateral margins.

Hypotype: Goias, Brazil. J. C. M. Carvalho.

Platyplellus atroluteus (Dist.), 1883

It appears questionable whether this species is congeneric with the above. The specimen studied has no connecting bar between the sclerotized rings and the appearance of the A structures on the posterior wall is quite distinctive.

Hypotype: M. Gerais, Brazil. Vicosa June 1944. J. C. M. Carvalho.

Opistheuria Reuter 1908

This genus contains only two described species, both found in the Neotropical region. Opistheuria is often considered closely related to Platyplellus. However, the female genitalia do not support this relationship. In this genus the sclerotized rings, (Plate V. Fig. 9), are widely separated and have no mesal connecting bar between them.

As in Platyplellus, no characters of the female genitalia aid in substantiating the present tribal distinction for this genus.

Opistheuria clandestina var. dorsalis Knight, 1918

Sclerotized rings: Prominent, irregularly elliptical, a strongly marked concavity near center of posterior margin; adjacent sclerotization weak and nearly uniform; rings widely separated mesad. Maximum length 31 mm., maximum width 68 mm. (Plate V. Fig. 9).
Posterior wall: A structures narrow, widely diverging laterad; structure B widened ventrad, a prominent enlargement ventrad of anteroventral curvature; structure C weakly sclerotized, composed of a twisted ring of membrane, emarginate along dorsal margin; structure D with ridge-like transverse thickenings of surface; structure E not visible posteriorly, but well developed. Maximum length .34 mm., maximum width .72 mm.; maximum length structure C .17 mm., maximum width structure C .25 mm. (Plate II. Fig. 10).


Oncerometopus Reuter 1876

This is a small Nearctic genus containing nine described species, all of which are found in the southwestern United States and Mexico. As in the other genera of this tribe, no characters appear to be present in the female genitalia to warrant tribal distinction.

Oncerometopus nigripalpus Reuter, 1876

Sclerotized rings: Rather short and relatively wide, broadest at lateral end, tapering to a blunt point near meson; no connecting bar between the rings as in Platytylellus, a rather well sclerotized plate (adjacent sclerotization) arising from the connecting piece, extending anteriorly under entire area of rings, this plate concave dorsad and appearing to act as support for the rings. Maximum length .20 mm., maximum width .86 mm. (Plate III. Fig 7).
Posterior wall: Generalized, structure B well developed, curving anteriorly at its most dorsal extension; structure C membranous, difficult to distinguish from surrounding membrane; structure E conspicuous, covered with short spines. Maximum length 0.32 mm, maximum width 0.61 mm.

Hypotype: Label illegible. X485 (Author's collection).

Creontiades Distant 1883

This is a moderately large genus of about forty-seven described species. The members of the genus are found in all the major faunal regions, but the greater number of species are Ethiopian and Oriental in distribution.

Only a single member of the genus has been studied. The female genitalia are somewhat suggestive of Adelphocoris. However, the closest relationship is with Horcias signoreti (Stal) to which it is related by the prominent antero-mesad projection of the sclerotized rings, and the relatively simple posterior wall with the dorsal margin of the A structures nearly straight. Much more material will need to be studied before any conclusions can be drawn as to the generic position of Creontiades.

Creontiades debilis Van Dusen, 1915

Sclerotized rings: Rings large, nearly meeting one another mesad, posterior margin concave; a delicate adjacent sclerotization arising near antero-mesal angle of rings and curving strongly
cephalad (specimen tender and this difficult to see). Maximum length .32 mm., maximum width .94 mm. (Plate IV. Fig. 13).

Posterior wall: Simple, A structures broad dorso-ventrally, ventral margin moderately curving, dorsal margin nearly straight; structure B simple; E structures well developed. Maximum length .17 mm., maximum width .65 mm.

Hypotype: Port Larosa, Tex. 1935. R. L. McGars(?).

**Neolygus** Knight 1917

This genus, formerly considered a subgenus of *Lygus*, contains thirty-one described species, all but two of which are confined to eastern and central North America in distribution, the other two species are European. Knight (1941) raises *Neolygus* to generic rank. As mentioned under the *Lygus* discussion, the female genital structures investigated lend much evidence to this view and indicate that the *Neolygus* group is not even closely allied to *Apolygus* in its affinities. Further evidence for the generic entity of *Neolygus* may be obtained from the very different nature of the male parameres (see Knight 1917, 1941) and some very interesting biological differences, such as restriction to single host plant, versus general feeding habits, and overwintering as eggs, versus overwintering as adults. The morphological and biological evidence therefore, seems to substantiate the fact that superficial resemblance has been the sole reason for placing *Neolygus* with the *Lygus* complex.
The female genitalia are quite distinctive and apparently represent highly specialized types. The sclerotized rings show almost no specific distinctions in the three species examined and the description of Neolygus communis Knight, below will serve for all the species studied. The posterior wall is quite unique, (Plate II. Fig. 9), the A structures are narrow, rather undulate in appearance, with structure B represented by a small round button near the dorso-mesal margin. The most striking feature of the wall is the tremendous development of what appear to be the E structures that arise from the extremities of the A structures. These sclerites may or may not be homologous to the sclerites found in other genera. They are enormously enlarged, considerably larger than the A structures and apparently fused along the median line. They lie with the free ventral margin tilted anteriorly from the dorsal more posterior margin; on the posterior face a secondary plate may arise and likewise another on the anterior face near the apex. The E structures are small, but extend prominently laterad of the A structures, (Plate II. Fig. 9).

Although the genus is certainly distinct, its affinities are obviously with Lygus pabulinus (considered in this paper as probably a distinct genus from Apolygus), the latter having the large plate-like structures present and possessing the same complicated series of plates present on the posterior wall, (Plate II. Fig. 18).

Neolygus communis Knight, 1917

Sclerotized rings: Large and prominent, sub-elliptical, narrowing mesad, posterior margin strongly concave, ring margins strongly
produced anteriorly at antero-mesal margin into a horn-like solerotized projection; margin of rings prominently folded for nearly its entire length; adjacent solerotization very weakly developed. Maximum length .61 mm., maximum width 1.15 mm. (Plate III. Fig. 9).

Posterior wall: As in generic discussion, with a prominent secondary plate arising near the dorsal margin of H structures on the posterior face and extending ventrad and laterad; H structures fused weakly and evenly along median line. Maximum length .47 mm., maximum width .72 mm. (Plate II. Fig. 9).


H. H. Knight.

*Neolygys omnivagus* Knight, 1917

Solerotized rings: As in *N. communis* Knight. Maximum length .53 mm., maximum width 1.18 mm.

Posterior wall: A structures as in *communis*; H structures distinctive, large and ovoid, with right solerite lying over left one on meson (posterior view), to give a layered appearance, dorsal margin strongly emarginate as is the secondary plate (see *N. communis*), this curving of the margin together with the secondary folding gives an invaginated appearance and may indicate the origin of the condition found in the *Neohorus* complex. In any case, the condition here apparently represents a more specialized condition than in the other species studied. Maximum length .51 mm., maximum width .72 mm.

Neolygus fagi Knight, 1917

Sclerotized rings: Similar to N. communis. Maximum length .50 mm., maximum width .98 mm.

Posterior wall: A structures as in above species; H structures very large, extending ventrad anterior to A structures, mesal connection consisting of only thin membrane to give appearance of two very distinct sclerites, posterior secondary fold very weakly developed and inconspicuous, dorsal margin only slightly emarginate and not appearing invaginated as in N. omnivagus. Maximum length .39 mm., maximum width .73 mm.


Stenotus Jakovlev 1877

This genus is composed at present of approximately thirty-five described species found in all the faunal regions of the world with the exception of the Neotropical. The majority of the species are African. Only one species, Stenotus binotatus (Fabr.), has been studied. The female genital parts indicate the genus to be very distinct and not closely allied to any other genera studied.

Stenotus binotatus (Fabricius), 1794

Sclerotized rings: Rings sub-elliptical, widely separated mesad, lying in an antero-mesal angle from posterior to anterior end; ring
selerotization strong, particularly inner margin; rings tapering strongly both caudad and cephalad, the cephalic tapering with tips not in contact; no apparent adjacent selerotization. Maximum length .45 mm., maximum width .90 mm. (Plate V. Fig. 7).

Posterior wall: Wide A structures present with a short B structure on posterior face; B structure not reaching ventral margin, widening dorsad and forking to form a wide lunate dorsal projection; E structures prominent; A structures strongly curving, nearly straight along ventral margin. Maximum length .43 mm., maximum width .69 mm. (Plate II. Fig. 4).


Polymerus Westwood 1839

This is a large genus composed of approximately seventy-six named species from all the major faunal regions of the world. Only a single species, Polymerus basalis Reut., has been examined. The affinities do not appear to be close to any other genus of the Capsinae studied. The posterior wall is of a very different type.

Polymerus basalis Reuter, 1876

Selerotized rings: Small and delicate for size of species, rings open at mesal margin to form one open area between ring margins rather than forming two distinct and separate rings; "rings" tapering laterad; adjacent selerotization present laterad of "rings", but poorly differentiated. Maximum length .12 mm., maximum width .40 mm.
Posterior wall: A structures reduced to narrow, strongly curving bands forming a lunate appearing structure, ventral margin strongly emarginate mesad; structure B absent, all dorsal parts membranous; E structures large, delicately selerotized. Maximum length .20 mm., maximum width .37 mm. (Plate III, Fig. 5).


Subfamily Mirinae Reuter 1910

Three species of this subfamily have been investigated during the present study. These species represent the genera Miris, Stenodema, and Collaria. In addition, Kullenberg (1947) has illustrated and described the female genitalia of certain species of Pithanus, Trigonotylus, Notostira, Teratooris, Miris and Stenodema.

Kullenberg (1947b) concludes that this group of genera is not worthy of subfamily status, but should at most be accorded tribal status in the Capsinae. The few species that have been examined by the author tend to confirm this view.

The selerotized rings are simple and relatively reduced in size, yet they show no greater divergence from the type found in the Capsinae than do some of the capsine genera from one another. The appearance of the posterior wall is of the greatest importance in evaluating the affinities of the group. This posterior wall, (Plate III.
Fig. 6), is of essentially the same type as that found in the Capsinæ. The A, B, C and E structures are very evident and as far as can be determined at present cannot be separated from the appearance of these structures in the Capsinæ. When it is realized that the tarsal arolia, are of the same type in the two subfamilies, the very close relationship of these two groups is at once evident.

Miris Fabricius 1794

As limited at the present time the genus contains eight species. The female genitalia of one species, the generotype, Miris dolobratus (L.) have been examined during the present study.

China (1943) used Leptopterna Fieber 1858 as the generic name of this group of species.

Miris dolobratus (L.), 1758

- Sclerotized rings: Very small, weakly sclerotized and inconspicuous for size of species; rings irregularly ovoid, widely separated mesad; well-developed sclerotization present laterad of rings extending ventrad of them toward midline and considerably cephalad of ring margin, this sclerotization not differentiated into F and G areas.
- Maximum length .19 mm., maximum width .43 mm. (Plate V, Fig. 21).

- Posterior wall: A structures narrow, forming a shallow median emargination along ventral margin, structure B with a dorsally directed flap arising from ventral margin, main shaft of B extended considerably dorsad of dorsal margin of A, strongly recurved cephalad;
structure C well developed; E structures narrow and inconspicuous, extending laterad of lateral margin of structure A only at the dorso-lateral extremity of A. Maximum length 1.19 mm., maximum width 1.04 mm. (Plate III, Fig. 1).


Stenodema Laporte 1832

This genus contains approximately twenty-seven species. The various species are found in all the major faunal regions of the world with the exception of the Australian.

The female genitalia of one species, S. vicinum (Prov.), have been examined. In addition, Kullenberg (1947a) described and figured S. laevigatum (L.).

The genus belongs to the Mirinae group, whether considered as a distinct subfamily, or as a tribe of the Capsinae, in the possession of very small inconspicuous sclerotized rings, (Plate V, Fig. 15), and in having the posterior wall strongly fused with the posterior ovipositor blades and lying mostly anterior to them rather than semi-dorsal as in most of the Capsinae. It is not however particularly closely related to Miris, the other genus of Mirinae studied, although the posterior wall is rather similar.

Stenodema vicinum (Provancher), 1872

Sclerotized rings: Rings very small, weakly sclerotized and inconspicuous for size of species, sub-rectangular with rounded
mesal margin and sub-truncate lateral margins, not widely separated mesad; adjacent sclerotization present at caudo-lateral margin of rings, tapering posteriorly, not extending anterior to rings. Maximum length .10 mm., maximum width .68 mm. (Plate V. Fig. 15).

Posterior wall: Similar in form to Miris dolobratus with narrow strongly curving A structures; structure B prominent, concave on posterior face, widening dorsad and possessing a small round, button-like C structure; E structures small, narrow, and apparently not extending laterad of lateral edge of structure A. Maximum length .11 mm., maximum width .68 mm.


Collaria Provancher 1872

This small genus contains seven named species, with the various species distributed in the Nearctic, Neotropical and Ethiopian regions of the world. The female genitalia of the generotype, C. meillerii Prov., have been examined. The sclerotized rings were not revealed by the dissection and may be absent or so delicately sclerotized as to be lost upon clearing. The posterior wall, (Plate III. Fig. 6), possesses the slender A structures found in Miris and Stenodema, and if this character is to be given much consideration Collaria must be grouped with the above mentioned genera.
Collaria melleurii Provancher, 1872

Sclerotized rings: Not evident.

Posterior wall: A structures slender, strongly curving dorsad, forming a very strikingly lunate arc; structure B prominent, ventrally forming a concave disc with the ventro-lateral angles produced ven-

trad as curving prongs, this disc tapering to a dorsal point somewhat dorsad of the dorso-mesal margin of the A structures; shaft of B extended dorsad and strongly recurved anteriorly at its apex;

structure C very prominent, composed of two irregular lobes; B struc-
tures exceeding lateral margins of A structures, but not approaching midline. Maximum length .25 mm., maximum width .65 mm. (Plate III. Fig. 6).


Subfamily Orthotylinae Van Duzee 1916

This is a tremendous subfamily composed of many hundreds of species and a great number of genera. The subfamily at the present time is separated into nine tribes. During the present study twenty-
five species, representing fourteen genera and seven tribes have been examined.

The majority of the Orthotylinae appear to represent a very specialized and highly differentiated condition. The tribes Semiini,
Labopini and Halticini apparently have only a distant relationship to the other tribes. This is true also of the one species of Pilophorus studied. The more "typical" members of the subfamily may be characterized as possessing sclerotized rings, (Plate VII. Fig. 5), in which the lateral margin of the ring, together with the adjacent lateral sclerotization, is strongly folded dorso-mesad, so that the fold projects a considerable distance into the interior of the ring, and, in some cases, extends across the ring to the mesal margin. As mentioned in the general subfamily discussion, this condition is suggested in the Phylinae and perhaps in a modified sense in the Derasocorinae, but it reaches a tremendous development in this subfamily.

The most distinctive feature of this group of species is the development of an anterior flange, or appendage, (K structure), (Plate VI. Fig. 16), on the lateral lobes (J structures) of the posterior wall of the bursa. These highly developed K structures are not present in any of the other subfamilies of the Miridae. These structures offer very good characters for the differentiation of species in all cases investigated, as well as being important in the recognition of relationships in the higher groups. K structures are present in all the species studied in the Lopidini, Orthotylini, and Ceratocapsini. It has been impossible with the present amount of material to separate the above mentioned three tribes satisfactorily upon the female genitalia. While certain differences exist between
the tribes, these differences are no greater than those found between different genera within the same tribe. Until the range of variation within any given tribe is fairly accurately known it will be impossible to know whether these genital structures have value in the definition of tribal limits.

In the Pilophorini representatives of two genera, Pilophorus and Pseudoxenetus, have been examined. These two genera differ greatly in the composition of the posterior wall. Pseudoxenetus possesses very large and well developed K structures, very like those found in the species of Lopidini and Orthotylini, (Plate VI, Fig. 17). Pilophorus, on the other hand, possesses a posterior wall that completely lacks the K structures and is rather unlike any other species of mirid studied, (Plate VI, Fig. 12). It seems obvious that Pseudoxenetus is considerably more closely related to the two tribes mentioned above than it is to the genus Pilophorus.

The tribe Halticini presents a very perplexing picture. Representatives of three genera of this tribe, Halticus, Strongylocoris, and Orthosephalus have been studied. Strongylocoris is the only genus of the three that possesses the K structures, (Plate VI, Fig. 18), and, as discussed under the generic description, the two species of this genus studied are certainly not congeneric. The species Orthosephalus mutabilis (Fall.) is one of the most interesting of all the Miridae studied. The posterior wall of this species, (Plate VI,
Fig. 4), is of the same type as that found in the Deracocorinae and Clivineminae, and is very similar to the posterior wall of Largidea rubida, (Plate VI. Fig. 2). The sclerotized rings of mutabilis are more similar to the type found in the Deracocorinae than they are to the majority of the species of Orthotylinae, (Plate VII. Fig. 6). It seems most questionable to the author whether this species really belongs with the Orthotylinae. If forms are found that more closely relate mutabilis to the Orthotylinae, then it certainly represents a connecting link between the Orthotylinae on the one hand and the Deracocorinae and Clivineminae on the other.

Halticus intermedius is another species that presents an anomalous situation. The sclerotized rings, (Plate VII. Fig. 1), are large and as closely related to the Capsinae as to any other group. These rings lack the tremendous infolded lateral margins of the majority of the orthotylines, although a very slight indication of this condition is present. The posterior wall of intermedius, (Plate VI. Fig. 9), is rather simple and unlike any other species studied. This wall offers no clue to the affinities of the species in relation to the other species studied.

The genus Labops, belonging to the tribe Labopini, illustrates another perplexing situation. Two species of Labops have been studied. The sclerotized rings, (Plate VII. Fig. 4), are infolded on the lateral margin, although less so than in the majority of the
Orthotylinae. However, the posterior wall is completely unique, (Plate VI, Fig. 14). It consists of two lateral lobes (J structures?) with large, strongly selerotized developments along the lateral and mesal margins of these lateral lobes. These selerotized areas may be homologous to the K structures of the other orthotylines, but they appear to be fused with the J structures rather than to proceed away from them as do the usual flange-like appendages.

The other species worthy of special note in this section is Semium hirtum Reut. In the general subfamily discussion this species has been discussed as an arsectant form between the Orthotylinae and the Phylinae. It is possible the species is actually referable to the Phylinae by virtue of its simple posterior wall, (Plate VI, Fig. 11). However, the selerotized rings are considerably more infolded than in any of the Phylinae studied, (Plate VII, Fig. 8). Therefore, it appears that in this species one is dealing with a type showing an intermediate position between two divergent groups.

Present evidence strongly indicates that the Orthotylinae, as limited at present, are not a homogeneous group. It is probable that as knowledge expands some of the genera will be removed to other subfamilies, or raised to the status of independent subfamilies. On the other hand, it is always possible that increased knowledge will show intergrading forms that will retain the subfamily in its present condition, although this is not considered likely by the
The evidence from this study would place those species with prominent K structures in one subfamily and reject from the subfamily limits the following genera: Semium, Labops, Orthocephalus, Halticus, and Pilophorus.

The Orthotylinae offer a most fruitful field for further investigation of the female genitalia, both in respect to higher group relationships and to specific differences.

In addition to the genital parts studied the vulvar area appears to offer a good potential field for profitable taxonomic investigation.

Halticus Hahn 1831

This genus contains approximately eighteen species. The various species are distributed in the Palearctic, Nearctic, Neotropical and Oriental regions and the oceanic Pacific islands. One species of the genus, H. intermedius Uhl., has been studied.

The relationships are obscure. Together with Orthocephalus, Labops and Semium this genus shows little affinity to the remainder of the Orthotylinae studied. The rings, (Plate VII. Fig. 1), and even the posterior wall to a degree, show a similarity to the condition found in the Capsinae. This posterior wall, (Plate VI. Fig. 9), also shows a rather definite relationship to Labops, but probably
represents a less extremely specialized type.

*Halticus intermedius* Uhler, 1904

**Selerotized rings:** Relatively large and strongly selerotized, narrowly separated mesad, mesal margin rounded, ring abruptly widening laterad, curving in an arc latero-caudal from meson to lateral angles, causing the meso-caudal margin to be strongly concave, this margin also forming a flange produced slightly dorso-laterad; lateral margin together with adjacent selerotization curving dorsad, but not folded over onto the ring as in most *Orthotylinae*; adjacent selerotization large, covering the entire area ventrad of the rings, broadly joined to the connecting piece; mesal angle of rings with short, broad mesal projections that appear to fuse on the meson; a delicate semi-circle of selerotized tissue curving mesad from posterior edge of meso-caudal flange to midline, giving a circular appearance to the area between the rings; adjacent selerotization not differentiated into F and G structures. Maximum length .43 mm., maximum width .94 mm. (Plate VII. Fig. 1).

**Posterior wall:** Small and simple, composed of two dorsally tapering and divergent selerites, suddenly narrowed almost at right angles near center of dorsal margin, ventral one-half thus only half breadth of apical half; a tumid mesal area bordered by a narrow indistinct more heavily selerotized ring. Maximum length .29 mm., maximum width .45 mm. (Plate VI. Fig. 9).

**Hypotype:** Trail Co., N. Dakota. August 14, 1925. A. A. Nichol.
Heterotoma Latreille 1825

This is a small Palearctic genus containing three described species. The female genitalia of the generotype, *H. meriopterum* (Scop.), have been examined. The female genitalia of this species have been described and figured by Hullenberg (1947a). However, since several authors have considered this the type genus of the subfamily it has been considered advisable to redescribe the female genitalia in this paper.

The species is typically orthotyline due to the presence of prominent K structures on the posterior wall and in the possession of strongly infolded lateral margins of the sclerotized rings and adjacent sclerotization.

*Heterotoma meriopterum* (Scopoli), 1763

Sclerotized rings: Rings with lateral margin together with adjacent lateral sclerotization strongly infolded, nearly reaching mesal margin of ring; ring sub-elliptical and strongly concave dorsally.

Maximum length .22 mm., maximum width .36 mm.

Posterior wall: L structure apparently absent; J structures large, almost in contact mesally at dorsal margin, diverging and tapering ventrad, terminating in a broadly rounded apex; K structures large and prominent with a deep central concavity, prominent lateral projection present that extends in an arc ventro-mesad, mesally with a large bulge that reaches to mesal margin of J structures. Length K structure .27 mm., width K structure .26 mm.

Orthoecephalus Fieber 1858

This is a small Palearctic genus composed of eighteen described species, with one species, *mutabilis* (Fall.), common to the Palearctic and Nearctic regions. The genitalia of one species, *O. mutabilis* (Fall.), has been examined. The subfamily position of this genus is very puzzling, it appears to be rather closely related to the *Deracocorinae* and *Clivinaeinae*, both in the twisted formation of the sclerotized rings, (Plate VII. Fig. 2), and in the simple, flattened, lobed condition of the posterior wall, (Plate VI. Fig. 4), of the bursa. Certainly Orthoecephalus has little in common with such "typical" orthotyline genera as *Orthotylus*, *Lopidea*, *Ilmocora*, etc. The posterior wall completely lacks the large prominent K structures so characteristic of these genera and the formation of the sclerotized rings is much more suggestive of *Deracocoris* and *Largidea* than any of the other *Orthotylinae* studied.

**Orthoecephalus mutabilis** (Fallen), 1807

Sclerotized rings: Very large for the species, strongly twisted, tapering antero-mesad to a blunt point, lateral margin curving strongly dorsad to a high point at the antero-lateral angle, anterior margin of ring lying ventrad of posterior margin and curving dorsad laterally; formation basically very much as in *Deracocoris quercicola* Knight, but lying in a somewhat different plane; connecting sclerotization broad, short, and strongly sclerotized, mesal margin produced into an elongate curving tongue-like fold that curves dorsad over mesal
margin of rings and extends as a long tongue to near median line. This development may well prove to be diagnostic for the genus. A moderately sclerotized sub-triangular F structure present along anterior margin of rings; rings very widely separated mesad and definitely of a deraeocorine type. Maximum length .24 mm., maximum width 1.01 mm. (Plate VII, Fig. 2).

Posterior wall: A simple sclerite, composed of two lobes (A structures) broadly fused mesad; A structures produced only slightly dorsad, forming a broad, shallowly concave dorsal margin to the structure; ventrad sclerite produced into a pair of blunt hook-like projections that curve mesad to nearly come into contact at the midline, forming an oval opening within their mesal margins, median area slightly more heavily sclerotized on each side of midline, but without a definite structure B. Maximum length .39 mm., maximum width .65 mm. (Plate VI, Fig. 4).


**Semium Reuter 1876**

This genus contains two species, both confined in distribution to the Nearctic region. The female genitalia of the generotype, *S. hirtum* Reut., have been examined.

This genus appears to be an annectant type, between the *Orthotylinae* and *Phylinae*. The interesting position of the genus is discussed under the subfamily and general discussion sections.
Semium hirtum Reuter, 1876

Sclerotized rings: Strongly sclerotized, subtriangular, tapering to a short blunt point antero-mesad; connecting sclerotization strongly developed, broad and short, widely in contact with connecting piece; this sclerotization folded dorsad, lateral to rings and curving over lateral ring margin, a short central area of this fold more strongly sclerotized, remainder semi-membranous; rings widely separated mesally. Maximum length .12 mm., maximum width .42 mm. (Plate VII, Fig. 8).

Posterior wall: Simple, consisting of a pair of A structures that curve dorsad and diverge from ventral to dorsal extremities and taper dorsad, a membranous ventral area present. Maximum length .19 mm., maximum width .29 mm. (Plate VI, Fig. 11).


Orthotylus Fieber 1858

This is a very large genus containing upwards of one hundred and eight described species. The genus appears to be absent from the Neotropical region. The majority of the species are found in the Palearctic and Nearctic regions. Four species, modestus, dorsalis, ornatus, and viridis, have been examined.

Orthotylus, the type genus of the subfamily, is very typical of those genera considered by the author to be "orthotyline" in the characters found in the female genitalia. The sclerotized rings have
the characteristic folding over, of the lateral margin and adjacent sclerotization (see subfamily discussion), (Plate VII. Fig. 2).

The posterior wall, (Plate VI. Fig. 28), possesses the characteristic J structures and these contain prominent K structures. These K structures bear a prominent lateral projection at the apical end and a bulging mesal margin. Sometimes this bulge may be produced, as in modestus, (Plate VI. Fig. 27), to form a blunt projection apically, in which case the tip of the K structure appears bifid.

The L area is small, relatively undifferentiated, and sometimes appears entirely membranous.

Orthotylus modestus Van Duzee, 1916

Sclerotized rings: Ring margin weakly sclerotized, rings elongate cephalo-caudal; lateral margin of rings together with lateral margin of adjacent sclerotization curving mesad as a bluntly triangular fold, extending into interior of ring proper; adjacent sclerotization prominent, concave, a prominent fold overlapping the caudo-mesal angle of the rings; connecting sclerotization deeply concave, broadly joined to the connecting piece. Maximum length .43 mm., maximum width .86 mm. (Plate VII. Fig. 2).

Posterior wall: J structures characteristic for genus; L structure not visible in specimen examined; K structures prominent, covered with hairs or spines, a median bulge strongly produced to form a bifid tip to K structure. Length K structure .31 mm., width K structure .19 mm. (Plate VI. Fig. 27).

Orthotylus dorsalis (Poirier), 1872

Sclerotized rings: See modestus.

Posterior wall: J structures as in modestus; K structures with a short thick apical projection, median bulge strongly rounded and prominent, attachment of K to J appearing sinuate. Length K structure .31 mm., width K structure .19 mm. (Plate VI, Fig. 29).


Orthotylus ornatus Van Dusé, 1916

Sclerotized rings: See modestus.

Posterior wall: J structures as in modestus; K structures with an elongate blunt, thick apical projection, median bulge nearer base than in other species studied, curving evenly from the apical tip, widest near base, attachment to J structures narrow and laterad.

Length K structure .28 mm., width K structure .16 mm. (Plate VI, Fig. 26).


Orthotylus viridis Van Dusé, 1916

Sclerotized rings: See modestus.

Posterior wall: J structures as in modestus; K structures similar to dorsalis, apical projection proportionately more elongate, median bulge less produced, giving K a less broadened aspect, attachment to J not appearing sinuate. Length K structure .26 mm., width K structure .14 mm. (Plate VI, Fig. 28).
Lopidea Uhler 1872

This is a large homogeneous genus containing sixty-two described species. The various species are confined in distribution to North and Central America with the greater number of species Nearctic in distribution.

The female genitalia studied are of a definite orthotyline type, with the sclerotized rings strongly twisted, the lateral margins forming an overlapping flap much as described for Orthotylus. The posterior wall, (Plate VI. Fig. 22), is also orthotyline in the possession of a median and two lateral solerites or lobes, (L and J structures), these latter each with a prominent K structure. This K structure is generically distinct from that of any other genera studied. It is composed of two narrow elongate projections curving ventrad with a very deep, broad concavity between them. The lateral projection appears to be always more elongate than the median and to possess a sharp angle along the lateral margin. The median projection possesses short hairs or setae that are reduced or absent on the lateral projection. Specific differences appear to be present in the conformation of these K structures, but it seems doubtful to the author if they will prove adequate to separate all the species of the genus from one another.
The following species of the genus have been examined: media, insurva, taton, staphyleae, robiniae, and heidemanni.

*Lopidea staphyleae* Knight, 1917

Posterior wall: L structure elongate, rectangular, (torn in dissection); J structures typical for genus with dorso-mesal corner curving below L structure and forming a narrow connecting band between J structures; K structures prominent, lateral and mesal projections relatively very slender forming a very broad U-shaped concavity within their margins. Length K structure .45 mm., width K structure .25 mm. (Plate VI, Fig. 21).


*Lopidea taton* Knight, 1923

Posterior wall: L structure broad, its dorso-lateral angles curved laterad into connecting bands that appear to connect with J structures, ventral margin broad and truncate, slightly swollen, mesal area bearing a more strongly sclerotized patch or knob that may represent a primitive, or vestigial B structure; K structures with projections rather stout, median projection tapering gradually to apex, lateral projection with a sharply angled bend on its lateral margin, apex very faintly hooked, extending considerably further ventrad than mesal projection. Length K structure .36 mm., width K structure .25 mm. (Plate VI, Fig. 22).

**Lopidea incurva** Knight, 1918

Posterior wall: L structure narrowing ventrad to terminate in a truncate slightly expanded apex; J structures normal for genus; K structures with lateral projection strongly tapered to a blunt point, median projection short, blunt and thick with bluntly rounded apex. Length K structure .23 mm., width K structure .22 mm. (Plate VI. Fig. 23).


**Lopidea heidemanni** Knight, 1917

Posterior wall: L structure subtriangular, tapering ventrad to a blunt rounded apex; J structures prominent, extending ventrad of projection of K structures, broadly truncate at apex; K structures relatively short and stout, lateral projection only slightly longer than mesal, with a short taper to apex. Length K structure .23 mm., width K structure .18 mm. (Plate VI. Fig. 26).


**Lopidea robiniae** (Uhler), 1861

Posterior wall: Very similar to *incurva*, particularly in form of K structures, median projection thickened, but less so than *incurva* and proportionately longer. Length K structure .29 mm., width K structure .19 mm.

Lopidea media (Say), 1832

Posterior wall: L structure somewhat as in incurva, dorsal margin less convex; J structures longer than K structures, lateral projection of K elongate distad of the angle, L structure elongate, strongly tapered to apex. Length K structure ~23 mm., width K structure ~18 mm.


Ilmacora Reuter 1876

This is a small genus composed of six species, all of which are confined in distribution to the Nearctic region. One species, I. malina Uhl., has been examined.

Ilmacora is a definite orthotyline type. The sclerotized rings are similar to those of Lopidea and Orthotylus, with the overlapping flap, composed of the lateral margin of the rings plus the adjacent lateral sclerotization prominent. The posterior wall has well developed K structures. In the species studied the K structures lack a mesal projection and appear to be rather closer to Orthotylus than to Lopidea, (Plate VI, Fig. 16).

Ilmacora malina Uhler, 1877

Posterior wall: L structure present as a wide sclerite, tapering to a blunt point ventrad, dorsal margin nearly straight, very slightly concave; J structures large, extending considerably ventrad of lateral projection of K structure, its meso-ventral margin shallowly
emarginate, median margin recurved laterad in a prominent flap that reaches laterally to mesal margin of K structure; K structures connecting with J structures near dorso-mesal angle of latter, K structure short with a right angle bend along lateral margin, a short stout lateral projection present, but no indication of a median projection. Length K structure .22 mm., width K structure .14 mm. (Plate VI. Fig. 16).


**Pilophorus** Hahn 1829

This is a moderately large genus composed of approximately forty-four species, the members of which are apparently absent from the Ethiopian, Australian and Neotropical regions. The female genitalia of *Pilophorus strobicola* Emgt. have been examined.

The sclerotized rings indicate that *Pilophorus* is only distantly related to the other *Orthotylinae*. The rings are quite prominent and large for the size of the insect, and the ring margins are not obscure and indistinct as they are in *Orthotylus*, *Lopidea* and *Ilmasora*, etc. However, the mesal folding of the lateral margin of the rings and the adjacent lateral sclerotization is of the same type as that found in other orthotyline forms, (Plate VII. Fig. 7). The condition of the posterior wall of the bursa copulatrix, (Plate VI. Fig. 12), is rather different from that of the more "typical" orthotylines. The wall resembles the above mentioned genera in being composed of three lobes or
sclerites, but differs primarily in apparently completely lacking
the K structures that form such a conspicuous feature of the pos­
terior wall of many of the Orthotylinae studied.

*Pilophorus strobicola* Knight, 1926

Sclerotized rings: Conspicuous, lying almost dorsal to
connecting piece that curves antero-mesad below rings; rings sub­
elliptical lying with long axis nearly cephalo-caudal, tapering dorso­
mesad; lateral margin of ring together with adjacent lateral
sclerotization folded dorso-mesad over ring and extending into
interior of ring; adjacent sclerotization prominent but relatively
undifferentiated. Maximum length .22 mm., maximum width .55 mm.
(Plate VII. Fig. 7).


The sclerotized rings of *Pilophorus walshii* Uhler 1887 have been
examined and found to be of the same type as those of *strobicola*
except that the posterior margin is somewhat wider due to the expan­
sion of the caudo-mesal angle of the ring.

Posterior wall: L structure very weakly sclerotized, almost
membranous, tapering to a blunt point at its dorsal apex; J structures
strongly curved dorsad and divergent, tapering to a point at dorsal
extremities, ventral margin consisting of a narrow band of strongly
sclerotized tissue, emarginate mesally, appearing to connect the L
and J structures; median area of this band with dorsal margin folded
ventrad in a tiny flange or flap; between posterior wall and shanks
apparently lies a slender accessory sclerite which is rather pro-
minent in this species. Maximum length .17 mm., maximum width .23
mm. (Plate VI. Fig. 12).


Labops Burmeister 1835

This is a small genus of approximately eight species, the members
of which are found in the Nearctic and Palearctic regions. The female
genitalia of two species, L. hirtus Engt. and L. hesperius Uhler,
have been examined. The genitalia of the members of this genus con-
stitute a very unique type and the affinities are obscure. The
sclerotized rings, (Plate VII. Fig. 4), show a small folding of the
lateral margin of the rings, somewhat as in the typical Orthotylinae.
Perhaps this character is sufficient to place the genus with the sub-
family Orthotylinae. The posterior wall of the bursa, (Plate VI.
Fig. 14), however, is a very unique structure. It consists of a pair
of J structures whose margins are heavily sclerotized and appear to
be of a different composition from the interior of the lobe. It is
possible this bordering sclerotization represents a K structure. The
mesal margin possesses spines and hooks that are in approximation on
the median line.

It seems very possible that Labops may represent a primitive
orthotyline type from which the more specialized members of the sub-
family have arisen.
Labops hirtus Knight, 1922

Selerotized rings: Very large for the species, rings elongate, lying meso-cephalad from lateral to mesal margins, tapering to a sharp point at antero-mesal angle, lateral margin possessing a small dorsal fold that curves mesad into interior of ring; a semi-membranous sheet of tissue connecting with apex of this infolded margin, extending over lateral ring margin and anteriorly along adjacent lateral selerotization; meso-caudal margin of ring possessing a folded over flange near center of margin; adjacent selerotization strongly selerotized, surrounding rings in a sub-elliptical concave form. Maximum length .52 mm., maximum width 1.01 mm. (Plate VII, Fig. 4).

Posterior wall: Composed of a pair of convex J structures with delicate membrane between, no indication of an L structure; J structures possessing a U-shaped selerotization along lateral and mesal margin, this selerotization appearing somewhat as a K structure with two elongate projections, but apparently firmly attached to lobes for entire length, mesal projection with an irregular row of teeth near middle and a deeply bifid apex; dorsally entire structure broadly rounded, lateral projections tapering ventrad to a pointed apex; J structure between marginal selerotization strongly convex (from a posterior view), laterally more heavily selerotized, this area twisting below strongly arched central portion of lobe. Maximum length .47 mm., maximum width .72 mm. (Plate VI, Fig. 14).


(Sclerotized rings).

*Labops hesperius* Uhler, 1872

One teneral specimen of this species has been examined. The sclerotized rings seem generally similar to those of *L. hirtus*, but are difficult to see. The mesal projection of the posterior wall (see *L. hirtus* above) is well developed and shows some excellent specific differences from *hirtus*, (Plate VI. Fig. 15). The apex of the mesal projection is not bifid and is spined along the latero-ventral margin, the median spines are differently arranged and the dorso-mesal angle is projected in a spinous process toward the mid-line, rather than being evenly rounded as in *hirtus*. The entire posterior wall is smaller than in the specimens of *hirtus* examined. Maximum length .34 mm., maximum width .58 mm. (Plate VI. Fig. 13).


E. L. Diven.

*Mecomma* Fieber 1858

This is a small genus containing five species, the members of which are found in the Palearctic and Neartic regions, with the exception of *madagascariensis* Reut. from the island of Madagascar. The female genitalia of one species, *M. gilvipes* (Stal), have been
The genus is a rather generalized orthotyline type, with the typical infolding of the lateral margin of the sclerotized rings, J structures that form the posterior wall of the bursa copulatrix, and with these J structures possessing well developed, simple K structures.

_Mesoemma gilvipes_ (Stal), 1868

Sclerotized rings: Small, orthotyline in character with strongly infolded lateral margins that extend mesad into interior of rings; ring margins indistinct, lying with long axis meso-laterad; rings very widely separated on median line. Maximum length .16 mm., maximum width .48 mm.

Posterior wall: J structures prominent, L structure reduced or absent; J structures short and broad, dorsal margin thickened throughout its width; a prominent pair of K structures present, apex considerably ventrad of J structures proper, tapering evenly to apex, no differentiation into lateral and median projections, lateral margin curving posteriorly and much more lightly sclerotized than the evenly tapering central area of flange. Maximum length .19 mm., maximum width .35 mm. (Plate VI. Fig. 19).

Strongylocoris Blanchard 1840

This is a small Holarctic genus composed of approximately twenty-two species. The female genitalia of two species, the generotype *leucocephalus* (L.), and *stygicus* (Say), have been examined.

It is interesting to discover that the type species of the genus, *leucocephalus*, is apparently not congeneric with the North American *stygicus*. Unfortunately, both of the available females of *leucocephalus* proved to be slightly teneral, or the posterior wall of the bursa is very lightly and delicately sclerotized. In any case, it has been impossible for the writer to clearly see the various parts of the posterior wall. However, enough can be ascertained to show that the structure lacks the well developed \( K \) structures and characteristic tri-lobed condition found in *stygicus*. Indeed, *leucocephalus* appears to approach the Capsinaceae in the general appearance of the posterior wall. The sclerotized rings are also very different in the two species. In *stygicus* a very characteristic orthotyline type is present, while in *leucocephalus* the rings are very complicated and twisted, (Plate VII, Fig. 6). A study of this genus appears to be necessary to ascertain the actual generic limits and to correctly place the *leucocephalus* type of female genitalia in relation to other mirids.
For the present all that can be said is that *stygicus* is a typical orthotyline with the usual infolding of the lateral margin of the sclerotized rings and prominent K structures arising from the J structures of the posterior wall of the bursa copulatrix, whereas *leucoscephalus* illustrates a unique and highly differentiated condition.

**Strongylocoris stygicus** (Say), 1832

Sclerotized rings: Typically orthotyline in possessing a large infolding of lateral margin of ring together with adjacent lateral sclerotization; form and shape very much as in *Orthotylus modestus*, (Plate VII. Fig. 2). Maximum length .16 mm., maximum width .72 mm.

Posterior wall: Composed of an L and two J structures; L structure broad and conspicuous, widening from dorsal base to a broad, truncate ventral apex, ventrally lying anterior to meso-ventral angle of J structures at margins; J structures large, extending ventrad of K structures, convex posteriorly, ventro-mesal margin shallowly emarginate, dorsal margin deeply incised mesad of base of K structures in a meso-ventral direction from the base; K structures much more heavily sclerotized than J structures, broad, with a prominent median bulge near base and a single apical projection that is twisted near apex; form of K structures suggestive of *Orthotylus ornatus*. Length K structure .26 mm., width K structure .17 mm. (Plate VI. Fig. 18).

Strongylocoris leucocephalus (L.), 1758

Sclerotized rings: Form complicated; rings with broad projecting lateral protrusions, posterior margin much curved and twisted, possessing a short flange that extends caudo-laterad and together with mesal portion of posterior margin of rings forms the anterior lip of a broad scoop-shaped structure that lies posterior to rings; mesad rings extend anteriorly in a broad bulge with median margins in very close approximation, a delicate adjacent sclerotization lies ventrad of rings and extends considerably cephalad of them; this adjacent sclerotization bearing a pair of irregular transverse plates directly cephalad of anterior margin of rings.

This type of ring unique among species of Miridae investigated during course of this study. Maximum length .38 mm., maximum width .78 mm. (Plate VII. Fig. 5).

Posterior wall: As mentioned above, the posterior wall in the specimens available has been unsuitable for illustration or description and for this reason the affinities of this species cannot be determined at the present time.

Ceratocapsus Reuter 1876

This is a large genus that contains approximately sixty species, the members of which are confined in distribution to the Western Hemisphere. By far the greater number of described species are found in North America. The female genitalia of two species, *fasciatus* Uhl. and *modestus* Uhl. have been examined.

*Ceratocapsus* represents a rather typical orthotyline type in the possession of sclerotised rings that have the lateral margins strongly infolded and the remainder of the ring margin depressed and inconspicuous. The posterior wall possesses paired J structures with prominent K structures present on the anterior surface. The J structures are broad and short and in both species studied have a noticeable median bulge near the base. The L structure appears to be absent, or little differentiated from the adjoining membranes, (Plate VI, Fig. 20).

The posterior wall shows excellent specific differences in the two species examined, but relatively little conformity to indicate generic characters.

*Ceratocapsus modestus* Uhler, 1887

Sclerotized rings: Typical orthotyline type.

Posterior wall: J structures very broad along dorsal margin, margin straight, lobes narrowing to a broad rounded apex, extending ventrad of K structures, median margin sinuate with a prominent basal
bulge; K structures leaflike, ovate, lying nearly transversely across J structures, attached near latero-dorsal angle of J structures, covered with short hairs or setae. Length K structure .18 mm., width K structure .10 mm. (Plate VI. Fig. 20).


Ceratocapsus fasciatus Uhler, 1877

Sclerotized rings: Typical orthotyline type.

Posterior wall: J structures broad and short, only slightly narrowed ventrad, ventral margin truncate, dorsal margin thickened into a calloused ridge, mesal margin sinuate, with a prominent basal bulge; K structures prominent, extending ventrad of J structures, of simple form in being composed of a single extension that tapers to a broad round apex, covered with short hairs or setae. Length K structure .17 mm., width K structure .11 mm. (Plate VI. Fig. 24).


Heterocondrus Fieber 1858

This is a small genus of thirteen described species, limited in distribution to the Palaearctic and Nearctic regions. The female genitalia of one Nearctic species, H. malinus Reut., has been examined.

The genitalia are of the very typical orthotyline character, with prominent infolding of the lateral wall of the sclerotized rings and the tri-lobed posterior wall that possesses a pair of prominent
K structures, arising on the caudal surfaces of the J structures.

Heterocondylus malinus Reuter, 1909

Sclerotized rings: Typically orthotyline with lateral margin of rings strongly infolded, ring itself weakly sclerotised, strongly concave on dorsal side, mesal margin also curved to give ring a compressed and enveloped appearance, lateral infolding with a short spur present, projecting ventrad from base of fold. Maximum length .36 mm., maximum width 1.35 mm.

Posterior wall: L structure very small, much shorter than large J structures, centrally located between them; J structures large, sub-rectangular, ventral margin truncate, dorsal margin calloused, tapering slightly ventrad, mesal margin nearly straight; K structures large, with a very broad base containing a prominent mesal bulge, a well developed lateral projection, hook shaped, entire flange covered with short hairs or setae. Length K structure .40 mm., width K structure .36 mm. (Plate VI. Fig. 15).


Pseudoxenetus Reuter 1909

This is a North American genus containing only two species. The female genitalia of one species, P. souellatus (Uhl.), have been examined.

The female genitalia are of the usual orthotyline type with exceptionally large infoldings of the lateral wall of the rings and
adjacent tissue, and prominent \( K \) structures on the anterior face of the tri-lobed posterior wall of the bursa copulatrix.

This genus is certainly very closely related to the European species of the genus **Cyllocoris**, if not congeneric with them. The sclerotized rings of \( P. \) *soutellatus* appear to be almost identical to those illustrated by Eullenberg (1947a), for **Cyllocoris flavoguadrimaculatus** (De G.). The posterior wall of the two species also is of the same type although exhibiting some specific differences. A study of all the species of these two genera to ascertain the degree of generic differentiation would seem to be very desirable.

**Pseudoxenatus soutellatus** (Uhler), 1890

Sclerotized rings: Large and prominent, typically orthotyline in having an infolding of lateral margin of ring plus adjacent lateral sclerotization, this infolding very broad and large, extending entirely over interior of ring and covering a portion of the mesal margin; a central sclerotized shaft formed from the lateral sclerotization is prominent in center of fold; ring margin prominent, not weakly developed and enveloped by the margins as in many **Orthotylinae**; rings widely separated mesad. Maximum length .36 mm., maximum width 1.01 mm. (Plate VII. Fig. 3).

Posterior wall: Composed of three lobes, \( L \) structure short, tapering to both dorsal and ventral extremities with a prominent widening in the center; \( J \) structures large, straight along dorsal
margin, narrowing to a broadly rounded ventral apex, mesal margin broadly bulging mesad along basal one-third of margin; K structures large and broad, not reaching ventrad to apex of J structures, a deep emargination present, that produces a long, broad, blunt lateral projection and a short, stout mesal one, this mesal projection less than one-half length of lateral projection, covered with short, stout setae or hairs. Length K structure .39 mm., width K structure .27 mm. (Plate VI, Fig. 17).

Subfamily Deraeocorinae Douglas & Scott 1865

This subfamily has been recently separated from the Capsinae because of the simple, hair-like condition of the tarsal arolia.

Two genera and six species of the subfamily have been studied during the present investigation. The female genitalia confirm the validity of separating the group from the capsines, although it appears to be very closely related to the Clivininae.

The sclerotized rings are strongly looped and twisted and show considerable variation among the species studied. It seems probable that the large genus Deraeocoris can be separated into several subgroups on the basis of these female structures, as of the five species of the genus studied, three fall into one group while the other two are rather distinct in the appearance of these rings.
The posterior wall in all the species studied is simple and composed of a single plate. This plate is, in most cases, deeply emarginate on the ventral margin and usually produced dorsad as a pair of diverging lobes, (Plate VI. Fig. 3). While this posterior wall is quite simple it suggests an advance over the two separate sclerites found in the Dicyphinae, Phylinae, and Hyaliodinae. This simple plated condition may very well have come about through a mesal fusion of the separate A structures of the above mentioned subfamilies. It seems quite probable that this type of posterior wall illustrates the generalized condition from which the specialized structures found in the Capsinae and Mirinae have developed. Indeed, as mentioned in the discussion of subfamilies, Deraeocoris histrio (Reut.) shows a mesal thickening not unlike the small B structures found in such capsine genera as Neurocolpus and its allies, (Plate VI. Fig. 8).

Similarities to some of the orthotylines can also be detected. The incurving of the lateral margins of the rings bears evident relationship to the infolding of the margin of the rings in the majority of Orthotylinae. Of more importance is the close similarity of the posterior wall in such a species as Orthocephalus mutabilis to the conditions found in the Deraeocorinae.
This is a very large genus of approximately one hundred and eighty species, the members of which are found in all the major faunal areas of the world. Five species of Deraeocoris have been investigated and all present a basically similar aspect in the female genital structures involved. All of the species agree in possessing well-developed sclerotized rings that are strongly twisted and often looped and connected with the "connecting piece" by a relatively slender band, or arm of sclerotized tissue. In all cases, the posterior wall is a simple plate with a pair of dorsally extended lobes that probably represent the ventral wings of the Capsinae. The ventral area of this plate is usually a thin membrane contrasting strongly with the more heavily sclerotized dorsal two-thirds. This ventral portion is easily overlooked or lost in dissection. Structure B is either absent or represented by a very small knob on the meson. Specific differences appear to be present in the formation of the posterior wall.

In a genus of this size it is impossible to ascertain the possible criteria for generic entity without a detailed study of many species from various parts of the world.

**Deraeocoris quercicola** Knight, 1921

Sclerotized rings: Strongly sclerotized, narrowing mesad, posterior margin depressed near lateral end where rings make a right angle bend and extend antero-dorsad, anterior margin of rings lying
more ventral than posterior margin and curving dorsal from mesal to lateral ends so that most dorsal portion of ring is where posterior and anterior ring margins appear to coalesce, from this point margin of connecting selerite joins, this selerite runs caudal to coalesce with the "connecting piece" which tapers from anterior to posterior ends and is strongly concave dorsal; anterior adjacent selerotization present (probably homologous to F structures of Capsinae), curving caudo-mesad along anterior margin of ring and possessing a sharp point at antero-lateral angle. Maximum length .36 mm., maximum width .36 mm. (Plate V. Fig. 10).

Posterior wall: Consisting of a pair of simple A structures, narrowly fused mesad, extending dorsal as two large lobes; ventral portion of selerite membranous, ventral margin strongly emarginate; more heavily selerotized dorsal two-thirds sloping posteriorly from lateral to mesal margin, broadly rounded, with deep central emargination between the two lobes. Maximum length .63 mm., maximum width .75 mm. (Plate VI. Fig. 3).


Dermestocoris nitentatus Knight, 1921

Selerotized rings: Similar in form to quercicola, rings narrower, mesal margin square out, appearing truncate rather than tapering to a blunt point; F structures weakly developed, bearing a distinct point at antero-lateral margin. Maximum length .25 mm., maximum width .79 mm.
Posterior wall: Similar to *quercicola,* A structures more broadly in contact mesally, their dorsal margins forming a broad shallow emargination rather than a deep one as in the above species; a small knob present on meson. Other features as in *quercicola.* 
Maximum length .50 mm., maximum width .65 mm. (Plate VI. Fig. 10).


_Deraeocoris nigritulus_ Knight, 1921

Selerotized rings: Ring formation appears identical with that of *quercicola,* but slightly smaller. Maximum length .30 mm., maximum width .78 mm.

Posterior wall: Similar to *quercicola.* A definite knob of selerotized tissue present on meson (structure B); dorsal emargination deep and V-shaped rather than broad at maximum indentation.

Maximum length .56 mm., maximum width .72 mm.


_Deraeocoris sayi_ Reuter, 1876

Selerotized rings: Basic pattern as in the above species, rings very strongly looped and twisted forming a figure eight when viewed from dorsal aspect, secondary flange present on connecting selerotization; adjacent selerotization weakly selerotized coming to a blunt point mesad. Maximum length .25 mm., maximum width .91 mm. (Plate V. Fig. 13).
Posterior wall: A structures very broad, widely divergent, with a broad, shallow meso-dorsal emargination, mesal connection narrow, the ventral membranous portion much reduced; indication of a minute weak B structure present. Maximum length .65 mm., maximum width 1.37 mm.


Deraeocoris histrio (Reuter), 1876

Sclerotized rings: Appearance as in quercicola, relatively much smaller, rings shorter and proportionately wider, tapering to a blunt point mesally. Maximum length .19 mm., maximum width .46 mm.

Posterior wall: A structures very widely divergent, little projected dorsally, forming a very shallow concavity on dorsal margin, ventral margin sinuate, depressed mesad, lobes evenly rounded; small B structure near ventral margin on meson, ventral membranous portion either lost in dissection, or naturally absent. Maximum length .22 mm., maximum width .53 mm. (Plate VI. Fig. 8).

Hypotype: Ames, Iowa.

Alloeotomus Fieber 1858

This is a small Palearctic genus containing three species. Of these, the type, A. gothicus (Fallen), has been examined. The genital structures place it beyond doubt in the subfamily Deraeocorinae. This relationship is born out by the condition of the arolia. The
affinities of the genus are clearly with *Deraeocoris*, both in the curving and twisting of the sclerotized rings and in the simple form of the posterior wall of the bursa copulatrix. Although it differs from any *Deraeocoris* studied it will be impossible to ascertain the generic characters of the female genitalia in this subfamily until an intensive study of *Deraeocoris* has been accomplished.

*Allocestomus gothicus* (Fallen), 1829

Sclerotized rings: Twisted, posterior margin curving ventrad at both ends, produced to form a flange-like lip, lateral margin produced dorsad almost at right angles near dorso-lateral angle; whole ring tapering mesad, general plan much as in *Deraeocoris*; adjacent sclerotization very large and prominent for size of rings, extending ventrad of rings to form a prominent ventral adjacent sclerotization; F structure present, thinly membranous and indistinct; rings relatively very small for size of species. Maximum length .14 mm., maximum width .48 mm. (Plate V. Fig. 20).

Posterior wall: Composed of a simple sclerite forming a pair of dorsally directed A structures, mesal connection moderately narrow, lobes broad and short forming a very broad, shallow dorsal emargination, ventral area of sclerite membranous, deeply emarginate mesad. This structure very much the type of *Deraeocoris*. Maximum length .31 mm., maximum width .61 mm. (Plate VI. Fig. 1).
Hypotype: Neschwitz, Oberlausitz, Germany. August 1, 1942.

K. H. C. Jordan.

Subfamily Clivineminæ Reuter 1875

Of this small subfamily a single species, Largidea rubida (Uhl.), has been studied. In addition, Eullenberg (1947a) gives excellent illustrations of the solerotized rings and posterior wall of Bothynotus pilosus Boheman. These two genera represent different tribes of the subfamily, and differ greatly in the appearance of the solerotized rings. In Largidea the rings are ovoid, and while somewhat curved are essentially simple in appearance, (Plate V. Fig. 22). In Bothynotus the rings are apparently rather similar to the type found in several members of the genus Deraeocorins, being infolded laterally and sub-triangular in shape. These rings are also rather suggestive of Orthocephalus mutabilis (Fall.).

The posterior wall in both these species is very similar to the type found in the Deraeocrinæ. Eullenberg's figure of Bothynotus pilosus shows the wall to be composed of two wide wing-like sclerites not fused along the median line. However, the general form and shape is very similar to the appearance of the posterior wall in the species of the Deraeocrinæ and in Largidea.

The Clivineminæ are certainly very closely related to the Deraeocrinæ and it seems very possible that future investigation
will show them to represent a single subfamily group.

Largidea Van Duzee 1912

This is a small Neartyo genus composed of four species. The simple condition of the posterior wall places this genus near the Deraeocorinae and certain of the anomalous Orthopyllinae, such as Orthocephalus. Indeed, the posterior wall is more nearly like that of Orthocephalus mutabilis (Fallen) than any other species studied.

Largidea rubida (Uhler), 1904

Sclerotized rings: Small, widely separated mesad, tapering from lateral to mesal margins, mesal margin rounded, lateral margin sub-truncate, ring margins relatively thick becoming more so laterad, lateral margin produced dorsad; adjacent sclerotization represented by a narrow irregular bar that reaches just cephalad of posterior angle of rings and slopes ventrad from lateral to mesal margins; a narrow membranous area surrounding rings and adjacent sclerotization, this membranous area rather uniform in composition. Maximum length .22 mm., maximum width .61 mm. (Plate V. Fig. 22).

Posterior wall: Simple, consisting of a single plate, narrowing dorso-laterad, deeply cleft or emarginate mesally on the ventral margin. Suggestive of Orthocephalus mutabilis (Fallen). Maximum length .19 mm., maximum width .49 mm. (Plate VI. Fig. 2).

Hypotype: Salida, Colorado. July 24, 1900. E. D. Ball (?).
Subfamily Hyaliodinae Knight 1943

This small subfamily formerly was included in the Diocyphinae. Only one species has been studied, *Hyaliodes harti* Knight. This species shows a close relationship to the Diocyphinae and Phylinae by reason of the simple paired solerites that comprise the posterior wall. The sclerotized rings, however, are considerably twisted and bear little relation to the simple elliptical aspect of the rings shown in the two tribes mentioned above, (Plate V. Fig. 8). In fact, the twisted condition is slightly suggestive of the Deraeocorinae. While this twisting possibly represents an independent variation, it is entirely possible that *Hyaliodes* may illustrate an intermediate condition between the Deraeocorinae on the one hand and the Phylinae and Diocyphinae on the other.

*Hyaliodes* Reuter 1876

This is a small genus containing approximately seven species. The members of the genus are confined in distribution to the Nearctic and Neotropical regions of the world. The female genitalia of a single species, *Hyaliodes harti* Knight, have been examined. The relationships are discussed under the subfamily heading above.
**Hyalodes harti** Knight, 1941

Sclerotized rings: Relatively large for size of species, transverse, rings strongly twisted and looped-over at lateral margin, elongate laterally and narrow cephalo-caudal, narrowly connecting by a sclerotized rod mesad, anterior margins possessing an anteriorly directed fold attached along mesal two-thirds of margin; surrounding areas membranous and undifferentiated. Maximum length .13 mm., maximum width .56 mm. (Plate V, Fig. 8).

Posterior wall: Simple and much like *Dicyphus discrepans* and the various species of the Phylinae investigated.

Hypotype: Urbana, Ill. V. E. Shelford.

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**Subfamily Phylinae** Reuter 1910

Of this large subfamily nine species have been studied, each representing a different genus. The material studied represents three tribes. *Chlamydatum*, *Gerhardiella*, *Plagiognathus*, *Psallus*, and *Reuter carnivorus* belong to the Phylinae; *Onoctylus* and *Lopus* to the Onoctylinae, and *Coquillattia* to the Haldodapini.

As mentioned in the general discussion of the subfamilies, the genital characters studied indicate that this subfamily is rather generalized and that the species probably represent relatively primitive forms. The Phylinae may be characterized as possessing
ovoid or sub-elliptical sclerotized rings, although these are sometimes modified considerably. The sclerotization adjacent to these rings is sometimes differentiated into various areas, but on the whole does not illustrate the definite regions present in such subfamilies as the specialized Capsinae.

The condition of the posterior wall has been considered very important in evaluating the phylogenetic position of this subfamily. The sclerotized parts of this wall consist of a pair of bilaterally symmetrical sclerites that are in close approximation ventrally, but diverge and taper dorsad to end in blunt points, (Plate VI. Fig. 7). These are considered as probably homologous to the A structures of the more specialized groups. In one species, *Reuteroscopus ornatus*, an additional differentiated area is present dorsad of these A structures, but this is considered for the present as merely a secondary acquisition, (Plate VI. Fig. 5).

With the relatively small amount of material studied it has been impossible to discover structures of value in separating the tribal groups on the basis of the female genitalia. The species studied do fall into three groups. The first, represented by *Gerhardiella*, *Plagiognathus* and *Psallus*, has the semi-membranous areas about the sclerotized rings broken up into a number of more or less poorly defined subdivisions, (Plate V. Fig. 18). This entire area is relatively much larger than in other species, causing the sclerotized rings to be very widely separated mesad,
(see discussion under the genera involved).

The other species present a much simpler picture in regard to the sclerotized ring areas than is the case with the preceding three species. Here a definitely ascertainable adjacent sclerotization is evident laterad of the rings and usually curving to a greater, or lesser, extent ventrad of them. The remainder of the area about the rings and particularly mesad of them appears to consist of a simple undifferentiated membrane, (Plate V. Fig. 17).

Reuterococcus ornatus is a somewhat anomalous species, insofar as its relationship to the other species of the subfamily are concerned. The adjacent sclerotization is large and shows some indistinct areas of differentiation, but is of a type wholly unlike that found in Psallus, Plagiognathus and Gerhardiella, (Plate V. Fig. 19). Further, the additional lobed areas of the posterior wall in ornatus indicate that this species is not closely related to the other species studied.

The relationship of the Phylineae to the more specialized Orthotylinae has been discussed previously. The slight infolding of the lateral margins of the rings, together with the lateral adjacent sclerotization, in some of the species is very indicative of the more advanced infolding found in the orthotylines. Of the greatest importance in this respect is the discovery of the apparently ancestral species, Semium hirtum, that shows at least as much relationship in
the genital parts studied to the *Phylinae* as it does to the majority of the *Orthotylinae*.

In summary, the female genital parts studied indicate that the *Phylinae* are a generalised, primitive group with simple selerotised rings, a posterior wall consisting of two simple paired selerites and a relationship to the *Orthotylinae* by reason of the infolding of the lateral margins of the rings, and the existence of a species that appears to be intermediate between the two subfamilies.

*Gerhardiella* Poppius 1911

This is a monotypic Nearctic genus erected by Poppius for his *G. rubida*.

The genital parts investigated indicate that this genus is a rather typical phyline type, with a simple posterior wall consisting of paired A structures surrounded by undifferentiated membrane. The selerotised rings indicate a relationship to *Psallus* and *Plagiognathus* in that the rings lie in a delicately selerotised semi-membranous plate that is sub-divided into several poorly differentiated areas. The lateral margins of the rings together with the lateral margins of the selerotised plates of these three genera are recurved slightly dorso-mesad and are in this respect suggestive of the condition found in the *Orthotylinae*. 
Gerhardiella rubida Poppius, 1911

Solerotized rings: Rings large, marginal sclerotization narrow throughout, shape irregularly sub-rectangular, mesal margin sinuate, posterior margin nearly straight, lateral margin rounded, with caudo-lateral angle together with adjacent solerotized area slightly dorsally infolded; surrounding sclerotization broadly connected to connecting piece, greatly subdivided mesad of rings, a more heavily sclerotized bar arising from cephalo-mesal angle of rings and extending cephalo-mesad to midline, a Y-shaped structure posterior to these bars with base of Y lying on midline and arms extending cephalo-laterad to cephalo-mesal angle of rings, remainder of area between rings composed of two lobes that extend posteriorly some distance caudad of posterior margin of rings. Maximum length .44 mm., maximum width 1.01 mm. (Plate V, Fig. 18).

Posterior wall: Typically phyline; consisting of a pair of simple sclerites (A structures), diverging and tapering dorsad; surrounding membranes undifferentiated. Maximum length .14 mm., maximum width .42 mm. (Plate VI, Fig. 7).


Psallus Fieber 1858

This is a very large genus containing approximately one hundred and twenty-seven species and numerous named varieties. The various
species of the genus are found in all the major faunal areas of the world, with the possible exception of the Neotropical region proper. However, the great bulk of the species are confined in distribution to the Nearctic and Palearctic regions.

The female genital parts have been studied for only one species, P. ancorifer (Fieb.). This species indicates that a close relationship exists between Psallus and Plagiognathus. This relationship has, of course, long been evident using various external parts as criteria. Until a large number of species of both genera have been studied it will be impossible to ascertain whether or not the genitalia substantiate the present generic concepts.

Psallus ancorifer shows its phyline character by the simple paired sclerites that make up the posterior wall. The sclerotized rings are surrounded by a broad, semi-membranous plate that is differentiated into several more or less distinct areas as is true for Plagiognathus and Gerhardiella, but not for the other genera of Phyllinae studied.

Psallus ancorifer (Fieber), 1858

Sclerotized rings: Rings delicately sclerotized, widely separated mesad, sub-oval, lying on a semi-membranous plate-like structure that is somewhat differentiated into definite areas; rings and adjacent tissue placed further caudad than in most Miridas, so that connecting piece passes ventrad of anterior region of ring rather than posterior to rings as in most species; lateral margins of rings
together with adjacent sclerotization extending considerably cephalad of rings and appearing creased or folded transversely near its anterior margin. Maximum length .50 mm., maximum width .79 mm. (Plate V. Fig. 16).

Posterior wall: Simple phyline type, composed of two simple A sclerites that taper dorsad.


Plagiognathus Fieber 1858

This is a large genus containing approximately ninety-two species and a considerable number of named varieties. The species are found in the Nearctic and Palearctic regions, with a single species described from Chile.

The genital parts of one species, P. politus Uhl., have been examined. Plagiognathus is apparently rather closely related to Psallus, as both genera have ovoid sclerotized rings placed on a large semi-membranous plate. The genus, in addition to its close approximation of the type of ring area found in Psallus, shows its phyline character by the simple A structures that form two dorsally tapering sclerites as in the other Phylinae.

Plagiognathus politus Uhler, 1895

Sclerotized rings: Rings small, irregularly ovoid, widely separated mesad, lateral margin together with adjacent sclerotization
slightly folded dorso-mesad, a delicate but distinct solerite present laterad and ventrad of ring proper, this solerotization broad and extending mesad and cephalad of ring; mesal semi-membranous portion differentiated by light folds or creases in anterior region; general conformation suggestive of Gerhardiella and Psallus. Maximum length .43 mm., maximum width .79 mm. (Plate V, Fig. 14).

Posterior wall: Typical phyline type.


Reuteroscopus Kirkaldy 1905

This is a Neartic genus composed of three species. The female genitalia of the generotype, R. ornatus (Reut.), have been examined during the course of this study.

Reuteroscopus is allied to the other Phylineae studied in the possession of a posterior wall composed of two simple dorsally tapering solerites. However, a pair of large semi-membranous lobes, (Plate VI, Fig. 5), are present dorsoad of the A structures which probably represents a specialization of the rather uniform membranous area found in other Phylineae. The solerotized rings are simple, but the adjacent solerotization is large and of somewhat different conformation than in the other Phylineae studied.
Reuteroscopus ornatus (Reuter), 1876

Sclerotized rings: Rings relatively small, transverse, tapering to a point mesad, slightly twisted so that the anterior margin is somewhat depressed below the posterior and lateral margins, ring widening laterad, lateral margin broad and sub-truncate, adjacent sclerotization large and conspicuous, curving mesad below rings, terminating mesad of mesal angle of rings and near the midline, widened anteriorly with several folds in the sclerite, caudo-laterally narrowing to fuse with connecting piece by an elongate narrow stalk. Maximum length .23 mm., maximum width .55 mm. (Plate V. Fig. 19).

Posterior wall: Composed of two simple dorsally tapering A sclerites as in other Phylinae; a pair of dorsally expanding lobes lying in membrane dorsad of A sclerites and narrowly connected mesally, (Plate VI. Fig. 5).


Chlamydatus Curtis 1838

This is a moderate sized genus of approximately twenty-three species. The various species are distributed in the Nearctic, Palearctic and Neotropical regions. The female genitalia of one species, C. associatus Uhl., have been examined.

The genital parts studied appear to be rather typically phyline in character. The species possesses simple, ovoid rings and a
posterior wall consisting of paired A structures as in the other Phylinae.

Chlamydatum associatus Uhler, 1872

Sclerotized rings: Very delicately sclerotized, ring margin so thin as to be difficult to discern for its entire margin, rings ovoid, closely approaching one another at midline; conspicuous adjacent sclerotization lying laterad and partially ventrad of rings. Maximum length .18 mm., maximum width .50 mm.

Posterior wall: Composed of two simple sclerites (A structures), tapering dorsad as in other Phylinae.


Lopus Hahn 1852

This genus is composed of three species, all three Palearctic in distribution, but the generotype, L. decor (Fall.), is also found in North America. The female genitalia of the generotype have been examined during the present study.

The relationship of the genus is with the other Phylinae in that the posterior wall is composed of two simple sclerites with undifferentiated adjacent membranes. The sclerotized rings are simple and show very close relationship to Oncotylus and a somewhat more distant relationship to Coquilletta.
Lopha decolor (Fallen), 1807

Scleritized rings: Transverse, sub-triangular, posterior margin flattened, anterior margin strongly rounded, lateral angle raised and together with laterally adjacent sclerotization slightly folded; adjacent sclerotization tapering posteriorly to connect to connecting piece by a narrow stalk, the sclerite sloping strongly ventrad below the rings from lateral to mesal margin, mesal margin only one-third of distance mesad of lateral angle of rings; adjacent sclerotization undifferentiated into F and G structures. Maximum length .16 mm., maximum width .35 mm. (Plate V. Fig. 12).


Coquillettia Uhler 1890

This is a Nearctic genus containing eleven described species. The female genitalia of one species, the genotype, C. insignis Uhler., have been examined.

The affinities of the genus are apparently with the other Phylinae studied. The posterior wall consists of simple paired A structures while the sclerotized rings are simple and slightly infolded at the lateral angle. This folding over which is noticeable in several Phylinae probably shows some relationship to the condition found in the more specialized Orthotylinae.
Coquilletta insignis Uhler, 1890

Sclerotized rings: Large and strongly sclerotized, rings diverging laterad from antero-mesal angle, sub-elliptical, antero-lateral margin flattened, posterior margin broadly rounded, antero-mesal angle produced into a point, caudo-lateral angle produced dorsad and slightly folded mesad, together with margin of adjacent sclerotization; lateral adjacent sclerotization conspicuous lateral to and slightly ventrad of margin of ring, extending cephalad of ring margin for most of length of ring, not differentiated into F and G structures. Maximum length 1.38 mm., maximum width 1.12 mm. (Plate V, Fig. 17).

Posterior wall: Typical phylloid type, consisting of a pair of simple sclerites (A structures) tapering dorsad, membranous portion of posterior wall appears to show a slight degree of differentiation, perhaps presaging the more complicated conditions found in the Capsinae.

Hypotype: Trinidad, Colorado, Stonewall 8500 ft. August 7, 1925. H. H. Knight.

Harposora Curtis 1858

This Palearctic genus contains two species. The genotype, H. thoracica (Fallen) 1807, has been examined. The female parts studied in this investigation are figured by Kullenberg (1947a). His figures agree in all respects with the specimen examined.
The rings are simple and strongly sclerotized; the posterior wall is composed of typical paired A structures that taper dorsad.

**Onoctylus** Fieber 1858

The author has examined a somewhat teneral specimen of *Onoctylus guttulatus* Uhler 1894. The sclerotized rings appear transverse and sub-triangular and are very suggestive of *Lopus decolor*. The condition of the posterior wall is difficult to ascertain, but it appears to be a typical phyline condition with simple paired A structures that taper dorsad.

**Subfamily Dicyphinae** Oshanin 1912

Of this small subfamily only one species, *Dicyphus discrepans* Knight, has been studied. As judged by the female genitalia, this species indicates the subfamily is very closely related to the Phylinae. The sclerotized rings are simple ellipses without evident differentiation of the adjacent sclerotization, (Plate V. Fig. 11). The posterior wall is composed of two distinct sclerites, (A structures), diverging and tapering dorsad, (Plate VI. Fig. 6). This posterior wall is the same type as that found in the Phylinae. It is interesting to note that Van Duzee in his 1917 Catalogue places the tribe Halloapini in the subfamily Dicyphinae, whereas it is now considered as a tribe of the Phylinae.
While it appears evident that the group is closely related to the Phylinae considerable work will be necessary to ascertain the actual systematic position of Dicyphus and its allies.

**Dicyphus** Fieber 1858

This is a moderately large genus of approximately fifty-four described species. The various species are present in all the major faunal areas of the world. The female genitalia of one species, *Dicyphus discrepans* Kngr., have been examined.

**Dicyphus discrepans** Knight, 1923

Sclerotized rings: Simple, consisting of a symmetrical ellipse that diverges laterad from anterior to posterior end; rings appear surrounded by simple membrane, not differentiated into F and G structures. Maximum length .19 mm., maximum width .30 mm. (Plate V. Fig. 11).

Posterior wall: Very simple, composed of a pair of simple sclerites, probably homologous to structure A, that taper from a thick blunt ventral area to a narrow point dorsad and are not in contact on meson; area between structures a simple membrane. Maximum length .15 mm., maximum width .22 mm. (Plate VI. Fig. 6).

Subfamily Bryoorinae  Douglas & Scott 1865

This subfamily appears to lack completely the sclerotized rings that form such a prominent feature of the bursa copulatrix in other subfamilies. This situation is true for the three species, representing three genera, examined, and is apparently true also for Bryooris pteridis Fallen described and figured by Kullenberg (1947a). As mentioned above, the female genitalia of three species have been examined. These species are: Nomallooris filiois (L.), Pymoderes quadriramatus Guerin and Halticottoma valida Reuter. The first of these, H. filiois (L.), belongs to the tribe Bryoorini Reuter 1910. In this species both the posterior wall and the ring area appear to be entirely membranous, the vulvar area also shows little differentiation. The female genitalia of this species have been described and figured by Kullenberg (1947a). P. quadriramatus Guer. and H. valida Reut. belong to the tribe Pymoderini Reuter 1910. Here also no sclerotization of rings or posterior wall could be ascertained. However, what is taken as the vulvar area is highly developed and strongly sclerotized. It appears likely that this region will reveal good taxonomic characters in this tribe.

The question at once arises as to the phylogenetic significance, if any, of the absence of differentiated structures in the genitalia of the species of this subfamily. It seems possible that one is
dealing here with a primitive group wherein the complex conditions found in other subfamilies have not appeared. This hypothesis is strengthened by the fact that the subfamily is relatively small in number of genera and species, yet some of the species are of rather wide distribution. Also, the fact that *Monalooris filicis* (L.) feeds upon pteridophytes seems rather significant. In any case, the ring and posterior wall obviously are not able to be used in this subfamily, although their absence may be of considerable phylogenetic importance.
LITERATURE CITED


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APPENDIX
Fig. 1. Dorsal view of genital structures pertaining to eighth abdominal segment, (Partially dissected), of Coquillettia insignis Uhler. X 14. E, selerotized ring; G, anterior ramus; C, connecting piece; N, body wall; N, anterior valvula.

Fig. 2. Dorsal view of genital structures pertaining to ninth abdominal segment, (Partially dissected), of Adelphocoris lineolatus (Goze). X 14. E, E structures; H, B structure; C, G structure; F, posterior ramus; M, posterior valvula; O, ovipositor sheath.

Fig. 3. Lateral view of the terminal segments of the abdomen of a female mirid, showing valvulae extruded. X 16. C, connecting piece; U, bursa copulatrix; F, posterior ramus; G, anterior ramus; O, ovipositor sheath; M, posterior valvula; N, anterior valvula. (Adapted from Mullenberg 1946).

Fig. 4. Neoborus glaber Knight. Anterior view of posterior wall. X 45.

Fig. 5. Xenoborus commissuralis Reuter. Anterior view of posterior wall. X 45.

Fig. 6. Neoborus palmeri Reuter. Anterior view of posterior wall. X 45.

Fig. 7. Tropidosteptes cardinalis Uhler. Anterior view of posterior wall. X 45. A, A structure; E, E structure; H, H structure; T, tubular evagination of the H structure.

Fig. 8. Neoborus pacificus Van Dusee. Anterior view of posterior wall. X 45.

Fig. 9. Tropidosteptes cardinalis Uhler. Dorsal view of selerotized rings. X 45.

Fig. 10. Neoborus palmeri Reuter. Dorsal view of selerotized rings. X 45.

Fig. 11. Xenoborus commissuralis Reuter. Dorsal view of selerotized rings. X 45.
Fig. 12. Lampethusa collaris Reuter. Posterior view of posterior wall. X 43.

Fig. 15. Paracaleocoris scrupeus (Say). Posterior view of posterior wall. X 43.

Fig. 14. Poeas reuteri Distant. Posterior view of posterior wall. X 43.

Fig. 16. Neurocolpus nubilus (Say). Posterior view of posterior wall. X 43.

Fig. 15. Neurocolpus nubilus (Say). Dorsal view of sclerotized rings. X 43.

Fig. 17. Neurocolpus tiliae Knight. Posterior view of posterior wall. X 43. A, A structure; B, B structure; E, E structure.

Fig. 18. Paracaleocoris johnstoni Knight. Posterior view of posterior wall. X 43.

Fig. 19. Lampethusa collaris Reuter. Dorsal view of sclerotized rings. X 43.

Fig. 20. Paracaleocoris scrupeus (Say). Dorsal view of sclerotized rings. X 43.

Fig. 21. Poeas reuteri Distant. Dorsal view of sclerotized rings. X 43.
PLATE II.

Fig. 1. *Bolteria luteifrons* Knight. Anterior view of posterior wall. X 43.

Fig. 2. *Capsus ater* (L.). Posterior view of posterior wall. X 43.

Fig. 3. *Dichrococtus rufipes* (Fallen). Posterior view of posterior wall. X 43.

Fig. 4. *Stenostes binotatus* (Fabr.). Posterior view of posterior wall. X 43.

Fig. 5. *Buchholoecus rufinascus* (Stal). Posterior view of posterior wall. X 43.

Fig. 6. *Platytyellus costalis* (Stal). Posterior view of posterior wall. X 43.

Fig. 7. *Platytyellus costalis* (Stal). B and C structures of posterior wall, anterior view. X 43.

Fig. 8. *Lygus vanfusmi* Knight. B and C structures of posterior wall, anterior view. X 43.

Fig. 9. *Neolygus communis* Knight. Posterior view of posterior wall. X 43.

Fig. 10. *Opistheuria clandestina* var. *dorsalis* Knight. Posterior view of posterior wall. X 43. B, C structure.

Fig. 11. *Irbiisia shulli* Knight. Posterior view of posterior wall. X 43.

Fig. 12. *Irbiisia shulli* Knight. B and C structures of posterior wall, anterior view. X 43.

Fig. 13. *Irbiisia shulli* Knight. Lateral view of B structure of posterior wall. X 43.

Fig. 14. *Lygus vanfusmi* Knight. Posterior view of posterior wall. X 43.

Fig. 15. *Stittoecapsus franseriae* Knight. Posterior view of posterior wall. X 43.
Fig. 16. *Irbisia sericans* (Stal). Posterior view of posterior wall. X 45.

Fig. 17. *Irbisia sericans* (Stal). Lateral view of B structure of posterior wall. X 45.

Fig. 18. *Lygus pabulinus* (L.). Posterior view of posterior wall. X 45.

Fig. 19. *Lygus rubicundus* (Fallen). Posterior view of posterior wall. X 45.

Fig. 20. *Thyrillus pacificus* Uhler. Posterior view of posterior wall. X 45.

Fig. 21. *Thyrillus pacificus* Uhler. Lateral view of B structure of posterior wall. X 45.

Fig. 22. *Calocoris ataticollis* (Stal). Posterior view of posterior wall. X 45.

Fig. 23. *Gargamus fusiformis* (Say). Posterior view of posterior wall. X 45.

Fig. 24. *Platylygus grandis* Knight. Posterior view of posterior wall. X 45. A, A structure; B, B structure; C, C structure; E, E structure; H, H structure.

Fig. 25. *Adelphocoris lineolatus* (Goëze). Posterior view of posterior wall. X 45.

Fig. 26. *Phytoecoris osborni* Knight. Posterior view of posterior wall. X 45.

Fig. 27. *Cocobaphes sanguinarius* Uhler. Posterior view of posterior wall. X 45.

Fig. 28. *Hercias dislocatus* (Say). Posterior view of posterior wall. X 45.

Fig. 29. *Poseilocapsus lineatus* (Fabr.). Posterior view of posterior wall. X 45.

Fig. 30. *Lygidea rosacea* Reuter. Posterior view of posterior wall. X 45.
PLATE III.

Fig. 1. *Miris dolabratus* (L.). Posterior view of posterior wall. X 45.

Fig. 2. *Pantilius tunicatus* (Fabr.). Posterior view of posterior wall. X 45.

Fig. 3. *Calocoris norvegicus* (Gmelin). Anterior view of posterior wall. X 45.

Fig. 4. *Borelias signoreti* (Stal). Posterior view of posterior wall. X 45.

Fig. 5. *Polymerus basalis* Reuter. Posterior view of posterior wall. X 45.

Fig. 6. *Collaria musilurii* Provancher. Posterior view of posterior wall. X 45.

Fig. 7. *Onicerometopus nigriolavus* Reuter. Dorsal view of sclerotized rings. X 45.

Fig. 8. *Platylygus grandis* Knight. Dorsal view of sclerotized rings. X 45.

Fig. 9. *Heolygus communis* Knight. Dorsal view of sclerotized rings. X 45.

Fig. 10. *Pantilius tunicatus* (Fabr.). Dorsal view of sclerotized rings. X 45.

Fig. 11. *Calocoris norvegicus* (Gmelin). Dorsal view of sclerotized rings. X 45. F, F structure; G, G structure; S, sclerotized ring.

Fig. 12. *Lygus atriflavus* Knight. Dorsal view of sclerotized rings. X 45.

Fig. 13. *Lygus plagiatus* Uhler. Dorsal view of sclerotized rings. X 45.

Fig. 14. *Calocoris biolavatus* (H.S.). Dorsal view of sclerotized ring, right side. X 45.

Fig. 15. *Calocoris fulvomaculatus* (De Geer). Dorsal view of sclerotized ring, right side. X 45.
Plate III.
Fig. 16. *Lygus hesperus* Knight. Dorsal view of sclerotized rings. X 43.

Fig. 17. *Lygus elisus* Van Dusen. Lateral projection of adjacent sclerotization of sclerotized ring area, right side. X 43.

Fig. 18. *Lygus vanduzeei* Knight. Dorsal view of sclerotized rings. X 43.

Fig. 19. *Lygus oblineatus* (Say). Dorsal view of sclerotized rings. X 43.
Fig. 1. *Platytylllus costalis* (Stal). Dorsal view of soleretised rings. X 45.

Fig. 2. *Diehrooscytus rufipennis* (Fallen). Dorsal view of soleretised rings. X 45.

Fig. 3. *Bolteria luteifrons* Knight. Dorsal view of soleretised rings. X 45.

Fig. 4. *Platytylllus circunmaculatus* (Stal). Dorsal view of soleretised rings. X 45.

Fig. 5. *Irbisia shulli* Knight. Dorsal view of soleretised rings. X 45.

Fig. 6. *Capsus ater* (L.). Dorsal view of soleretised rings. X 45.

Fig. 7. *Irbisia sericans* (Stal). Dorsal view of soleretised rings. X 45.

Fig. 8. *Horcas dislocatus* (Say). Dorsal view of soleretised rings. X 45.

Fig. 9. *Thyrillus pacificus* Uhler. Dorsal view of soleretised rings. X 45.

Fig. 10. *Caranbus fusiformis* (Say). Dorsal view of soleretised rings. X 45.

Fig. 11. *Phytocoris osborni* Knight. Dorsal view of soleretised rings. X 45.

Fig. 12. *Coccbaphes sanguinarius* Uhler. Dorsal view of soleretised rings. X 45.

Fig. 13. *Creontiades debilis* Van Duzee. Dorsal view of soleretised rings. X 45.

Fig. 14. *Horcas signoreti* (Stal). Dorsal view of soleretised rings. X 45.

Fig. 15. *Poeoilocaprus lineatus* (Fabr.). Dorsal view of soleretised rings. X 45.

Fig. 16. *Euohiloecoris rufinasis* (Stal). Dorsal view of soleretised rings. X 45.
Plate IV.
PLATE V.

Fig. 1. Lygidea rosacea Reuter. Dorsal view of sclerotized rings. X 45.

Fig. 2. Stitocapsus franseriae Knight. Dorsal view of sclerotized rings. X 45.

Fig. 3. Lygus pabulinus (L.). Dorsal view of sclerotized rings. X 45.

Fig. 4. Polymerus basalidis Reuter. Dorsal view of sclerotized rings. X 45.

Fig. 5. Lygus rubiundus (Fallen). Dorsal view of sclerotized rings. X 45.

Fig. 6. Adelphocoris rapidus (Say). Dorsal view of sclerotized rings. X 45.

Fig. 7. Stenotus binotatus (Fabr.). Dorsal view of sclerotized rings. X 45.

Fig. 8. Hyaliodes harti Knight. Dorsal view of sclerotized rings. X 45.

Fig. 9. Opistheuria clandestina var. dorsalis Knight. Dorsal view of sclerotized rings. X 45.

Fig. 10. Deraeocoris quercicola Knight. Dorsal view of sclerotized rings. X 45.

Fig. 11. Dicyphus discrepans Knight. Dorsal view of sclerotized rings. X 45.

Fig. 12. Lopus decolor (Fallen). Dorsal view of sclerotized rings. X 45.

Fig. 13. Deraeocoris sayi Reuter. Dorsal view of sclerotized rings. X 45.

Fig. 14. Plagiognathus politus Uhler. Dorsal view of sclerotized rings. X 45.

Fig. 15. Stenodema vicinum (Provanche). Dorsal view of sclerotized rings. X 45.
Fig. 16. *PsalliUS ancorifer* (Fieber). Dorsal view of sclerotized rings. X 43.

Fig. 17. *Coquillettia insignis* Uhler. Dorsal view of sclerotized rings. X 43.

Fig. 18. *Gerhardiella rubida* Poppius. Dorsal view of sclerotized rings. X 43.

Fig. 19. *Reuterococcus ornatus* (Reuter). Dorsal view of sclerotized rings. X 43.

Fig. 20. *Allestomus gothicus* (Fallen). Dorsal view of sclerotized rings. X 43.

Fig. 21. *Miris dolobratus* (L.). Dorsal view of sclerotized rings. X 43.

Fig. 22. *Largidea rubida* (Uhler). Dorsal view of sclerotized rings. X 43.
PLATE VI.

Fig. 1. **Allactomus gothicus** (Fallen). Posterior view of posterior wall. X 45.

Fig. 2. **Largidea rubida** (Uhler). Posterior view of posterior wall. X 45.

Fig. 3. **Deraeocoris quercicola** Knight. Posterior view of posterior wall. X 45.

Fig. 4. **Orthosephalus mutabilis** (Fallen). Posterior view of posterior wall. X 45.

Fig. 5. **Reuterococcus ornatus** (Reuter). Posterior view of posterior wall. X 45.

Fig. 6. **Dicyphus discrepans** Knight. Posterior view of posterior wall. X 45.

Fig. 7. **Gerhardiella rubida** Poppius. Posterior view of posterior wall. X 45. A, A structure.

Fig. 8. **Deraeocoris histrion** (Reuter). Posterior view of posterior wall. X 45.

Fig. 9. **Halticus intermedius** Uhler. Posterior view of posterior wall. X 45.

Fig. 10. **Deraeocoris nitentatus** Knight. Posterior view of posterior wall. X 45.

Fig. 11. **Semium hirtum** Reuter. Posterior view of posterior wall. X 45.

Fig. 12. **Pilophorus strobicola** Knight. Anterior view of posterior wall. X 45.

Fig. 13. **Labops hapsorus** Uhler. Anterior view of mesal area of posterior wall. X 45.

Fig. 14. **Labops hirtus** Knight. Anterior view of posterior wall. X 45.
Plate VI.
Fig. 15. Heterocordylus malinus Reuter. Anterior view of posterior wall. X 45. J, J structure; K, K structure; L, L structure.

Fig. 16. Ilacora malina Uhler. Anterior view of posterior wall. X 45.

Fig. 17. Pseudoxanetus scutellatus (Uhler). Anterior view of posterior wall. X 45.

Fig. 18. Strongylocoris stygius (Say). Anterior view of posterior wall. X 45.

Fig. 19. Necromagilipes (Stal). Anterior view of posterior wall. X 45.

Fig. 20. Ceratocapsus modestus Uhler. Anterior view of posterior wall. X 45.

Fig. 21. Lopidea staphyleas Knight. Anterior view of posterior wall. X 45.

Fig. 22. Lopidea teton Knight. Anterior view of posterior wall. X 45.

Fig. 23. Lopidea incura Knight. Anterior view of posterior wall. X 45.

Fig. 24. Ceratocapsus fasciatus Uhler. Anterior view of posterior wall. X 45.

Fig. 25. Lopidea heidemanni Knight. Anterior view of posterior wall. X 45.

Fig. 26. Orthotyulus ornatus Van Dusee. Anterior view of posterior wall. X 45.

Fig. 27. Orthotyulus modestus Van Dusee. Anterior view of posterior wall. X 45.

Fig. 28. Orthotyulus viridis Van Dusee. Anterior view of posterior wall. X 45.

Fig. 29. Orthotyulus dorsalis (Provansher). Anterior view of posterior wall. X 45.
PLATE VII.

Fig. 1. *Halticus intermedius* Uhler. Dorsal view of selerotized rings. X 43.

Fig. 2. *Orthotylus modestus* Van Duzee. Dorsal view of selerotized rings. X 43.

Fig. 3. *Pseudoxenetus seutallatus* (Uhler). Dorsal view of selerotized rings. X 43.

Fig. 4. *Labops hirtus* Knight. Dorsal view of selerotized rings. X 43.

Fig. 5. *Strongylocoris leucocephalus* (L.). Dorsal view of selerotized rings. X 43.

Fig. 6. *Orthocephalus mutabilis* (Fallen). Dorsal view of selerotized rings. X 43.

Fig. 7. *Pilophorus strobicola* Knight. Dorsal view of selerotized rings. X 43.

Fig. 8. *Semium hirtum* Reuter. Dorsal view of selerotized rings. X 43.
Plate VII.